THE AIR POWER HISTORIAN

JULY 1958

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It is the policy of *The Air Power Historian* neither to endorse nor subscribe to the views expressed in the articles it presents. Many events in history must perforce remain controversial by reason of the multiplicity of interpretations given these events by those who participated in them, or have studied them from hindsight. Appropriate articles are invited for consideration.

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Credit: Smithsonian Institute

This is a close-up of Dr. Robert H. Goddard holding his famous 1926 liquid-fueled rocket. Dr. Goddard has long been considered the father of modern rocketry. The rocket itself is now on display in the National Air Museum, Smithsonian Institute, Washington, D. C.

THE RENAISSANCE OF GERMAN AIR POWER 1919 - 1932

By DR. EUGENE M. EMME

The rise and fall of the German Air Force is an important segment of military history not well studied by Americans. An examination of the German experience offers useful perspective on some of the timeless interrelationships between force and policy in the formulation of national strategy in the modern era. It also seems recommended that the study of a vanquished nation's misfortunes in warfare, particularly with regard to its employment of air forces, merits greater attention in the staff colleges of the victor nations in the late war.

From the Peace Treaty of 1919, through the Nazi Luftpolitik *in the "Appeasement Cold War" of the late 1930's, to the* Blitzkrieg *victories and eventual total defeat of the Third Reich in World War II—this is a detailed and historically significant subject for the serious student of military affairs. These were days of short-legged aircraft and TNT bombs, to be sure. But for the European nations clustered on a small peninsula of Eurasia, air power was a vital strategic factor in the problems of war and peace as soon as World War I had ended.*

The Luftwaffe *of Hitlerian Germany, which helped scare Britain and France into the surrender at Munich in 1938 and which shocked Europe into the "Phony War" after the Polish campaign, was spawned in the early days of peace after the end of the first world war. The article below helps document how the renaissance of German air power was partly a result of the work of the Allied peacemakers for whom World War I had been considered a bloody conflict fought to end war. The open and legal rise of German aviation within the terms of the Versailles Treaty, as well as the oft-exaggerated secret rearmament efforts, is a story which should interest thinking airmen as well as objective military historians today.*

The article below was extracted from a more detailed monograph, a forthcoming book entitled, Luftpolitik: The Influence of German Air Power Upon History, 1919-1940. *Dr. Emme is currently a division director in the new Operations Research Office of the Federal Civil Defense Administration's national headquarters in Battle Creek, Michigan. He wrote his doctoral dissertation on the subject of German Air Power between World Wars at the State University of Iowa, one of the first theses in the nation on the subject of air power. After 1949 he was a research consultant with the Air University, serving two years with the Research Studies Institute, five and a-half years as Director of Graduate Study and Research Advisor on the Air War College faculty, and later with the USAF Extension Course Institute.*

The aerial bombing of London, Paris, Nancy and the Rhineland during the first World War rained relatively minor destruction upon life and property far from the battlelines. Such operations had a very limited effect upon the course of the war itself. World War I brought to a close the historic era of limited warfare between the great nations. Technology helped make this so. The formidable fact erected itself in 1919 that the effective waging of war could apparently no longer be restrained by any universal doctrine governing the increasing totality of combat other than reciprocity. By the end of World War I, life had been breathed into dire predictions of things to come. Some of these dark warnings about the threat of future warfare to social organization—particularly the threat of air warfare to the nerve centers of modern society, the city—had been startlingly envisioned by H. G. Wells and Guilio Douhet even before Louis Bleriot had flown from Calais to Dover in his kite-like monoplane. With the coming of peace in November 1918, many sane and humanitarian hopes were fostered that these predictions were not to be. But men, and not machines, were to determine the course of forthcoming historical events.

The peace conference at Versailles in 1919 sought to institute a permanent state of international peace and stability. From the first, however, the peacemakers were to be plagued by the thorny problem of determining a "civilized role" in international affairs for modern military forces vastly improved by the swift technical advances stimulated by the war. The Allied and Associated Powers were the victors, Germany among the vanquished, on the field of what had been largely a bloody land battle. The impact of technological progress upon the art of future warfare and diplomacy was inevitable. Far-reaching consequences were to result from rise of air power as a major influence upon the security and prosperity of the most advanced nations. Within the span of twenty years after the end of World War I, the naked military threat which the German Air Force appeared to hold menacingly over the peoples of London and Paris was to be held in highest regard by British and French statesmen at Munich time. Thus, they were assisted in their reluctance to view the legitimate objective of war as the establishment of a more perfect peace until Adolf Hitler also grasped the military initiative, and the so-called "Phony War" came to an end in May 1940. The haunting nightmare of a World War II during the European Cold War of the late 1930's brought the greatest strategic victories to the German *Luftwaffe* before a shot was fired in anger. How this tragic situation came about for the democracies of Western Europe, merits retelling.

AIR POWER AND PEACE IN 1919

The peacemakers of 1919 faced the novel problems relative to the regulation of defeated Germany's air power with a predominant concern for the military aircraft. They disarmed Germany of its military air force and ordered the destruction of all military aircraft. At the same time, the Allies promised Germany in the Versailles Treaty that general universal disarmament would be instituted as soon as collective security for all nations was achieved under the aegis of the League of Nations.[1] The prodigious develop-

[1] Best analyses of Allied definitions concerning the disarmament and control of German aviation are K. W. Colegrove, *International Control of Aviation* (Boston: 1930) and John C. Cooper, *The Right to Fly: A Study of Air Power* (New York: 1947), pp. 27-99.

ment of civil aviation in Germany during the early years of peace, however, soon indicated a broader meaning to aviation as an instrument of national policy than that defined by the peacemakers. The renaissance of German air power began before the ink was dry on the Treaty of Versailles. As we shall see, aeronautical developments during the entire period of the German Weimar Republic were essentially those blessed with legality under the terms of the peace treaty. Only the clear prohibition on maintaining a military air force and the express restriction on the manufacture or importation of military aircraft hindered the development of air power in defeated Germany. These restrictions proved no hindrance to strengthening, if not stimulating, the sinews of air power in a technically progressive and economically powerful nation such as Germany. The rise of the phoenix of German militarism from the ashes of defeat was, in the final analysis, to be promoted by the policies of the peacemakers. The restrictions they attempted to impose on German aviation and the stimulation of German military thought by prohibiting an air force—these policies of the peacemakers were to backfire. The *Luftpolitik* of Adolf Hitler's Third Reich in dominating the diplomatic affairs of Europe before World War II, as well as the later victories of the *Blitzkrieg*, were a direct product of the peace imposed upon Germany at the end of World War I.

Germany became, for the first time in its history, a republic at the end of World War I. Aviation as an instrument of national policy in the Weimar Republic resulted in its outward form by the stimulating effect of the peace terms upon postwar German aviation and by the dynamic character of technical progress in aeronautics itself. In its inner organization, German aviation as a political and military expression of national power was to emerge out of two major areas: (1) the administration and stimulation of civil aviation conducted by the *Reichsvekehrministerium* (Transport Ministry); and (2) the theoretical planning and clandestine efforts to foster military aviation sponsored by the *Reichswehrministerium* (Defense Ministry). Surreptitious air rearmament during the German democratic experiment was, in spite of many misinformed students of history, of less historic significance than the tremendous open growth of civil and commercial aviation, and the political and popular support it enjoyed through Weimar Germany. Nevertheless, the theoretical foundation and organizational basis for the German Air Force under the Nazis did come into being under the Republic.

The air clauses of the Treaty of Versailles and their enforcement placed obstacles in the way of the normal growth of commercial aviation in postwar Germany. Most harshly regulated by the victors during the early years of peace was the aircraft industry. Until 1922, it was prohibited from the construction of any aircraft or motors, civil or military. This was an Allied definition bitterly resisted, sometimes violated and circumvented, for it virtually eliminated the legal basis for a war-bloated industry and also necessitated the use of obsolete military aircraft in commercial operations. Moreover, it excluded German firms from engaging in the world market for aircraft except through the cannibalistic practice of selling technical patents. Most of the prominent German aeronautical scientists and engineers were forced to move abroad, some of whom later returned to Germany after 1926 when a more favorable political climate existed for German aviation.[2] Under the so-called "Nine Rules" promul-

gated by the Allies in November 1922, the remnants of the German aircraft industry were allowed only to construct low-powered civil aircraft. This initiated sport flying on a massive scale. The *Leichtflugzeug* (light plane) resulting from the Allied regulations assisted the early and widespread popularity accorded private sport flying in Germany. Soaring and gliding, as is better known, had previously focussed popular attention on Germany's aviation position and had become, by 1922, a nation-wide sport. To a considerable extent, the highly popular sport of gliding came to symbolize within Germany (as it did abroad in uneasy years to follow) effective resistance against the so-called "fetters of Versailles."[3]

It was through the strenuous efforts of Oskar Ursinus, editor of a popular magazine, *Flugsport,* that the annual Rhoen Soaring Flight was revived in 1920. The heroic spirit of Otto Lilienthal was a central theme in the efforts to stimulate gliding in Germany. After his tour of Europe in 1921, General "Billy" Mitchell stated in his official report:

> In Germany we found a greater confidence in aeronautics probably than in any other country. This is due to two things: (1) that the Germans have so highly developed their lighter-than-air and heavier-than-air construction; and (2) that they know that their aviation can dominate the North Sea and English Channel and can put France out of business provided they have the chance to build.[4]

There appears little doubt, however, that on the basis of the number of persons participating in and the nation-wide publicity concerning "air sports," that aviation as a popular activity was an early phenomenon in Germany, at least until the Soviet Union initiated its "air-mindedness" program on a massive scale in the early 1930's. In 1924 the six largest aero societies in Germany had a combined membership of some 50,000, the most active organization being the Aero Klub von Deutschland.[5] But it was in pioneering commercial air transport that Germany's air power potential was to be most notably demonstrated.

SOVEREIGNTY AND AIR TRANSPORT

Germany was excluded from the Paris Air Convention of 1919 which established a regime of law to regulate international air commerce and which forced Germany to grant the Allies' "most favored nation" air rights until January 1923. The swift development of civil airlines right after the war in Germany served to aggravate fears, particularly in France, of a revived

[2] Anthony Fokker moved his entire factory through customs back to Holland; Hugo Junkers established a plant at Malmo, Sweden, and another later near Moscow, for the assembly of parts manufactured at Dessau; Claude Dornier moved his plant around Lake Constances into Switzerland and also built a factory in Denmark. Ludwig Pradtl and Theodor von Karmen emigrated to the United States. After the Treaty of Rappalo with Russia, many German technicians helped establish the Soviet aircraft industry. After 1926, the German aircraft industry was "liberated" from all restrictions on aircraft manufacture except for the prohibition on military prototypes.

[3] Gliding had, as the biographies of many GAF officers of World War II reveals, great attraction for youth. Willi Messerschmitt first designed gliders. As a political device, gliding was later exploited by the Hitler Youth and the National Socialist Flying Corps. The actual importance of gliding in the rapid aerial rearmament of Germany under the Nazis has generally been grossly exaggerated. Cf. C. C. Grey, *The Luftwaffe* (London: 1944), pp. 137f.

[4] As quoted in Issac D. Levine, *Mitchell: Pioneer of Air Power* (New York: 1943), pp. 275-76.

[5] Best general reference is Peter Supf, *Das Buch der deutschen Fluggeschichte* (Berlin: 1935), volume II.

German aerial menace. Further, there were flagrant infractions by the Germans of the Allied prohibition of any aircraft manufacture. The knowledge of illegal German production of aircraft was a topic of considerable discussion at the international conference tables. One observer recorded a session of the Allied Council of Ambassadors as follows:

> Yesterday the conference after a long discussion referred the questions relating to the breaches of the naval, military and air clauses to experts to be presided over by Marshal Foch. Foch says that the German aerial menace is more deadly than ever in its potential means of destruction, and unless steps are taken to prevent the Germans from manufacturing aircraft, they may at any minute destroy the *morale* of a nation by sudden attack. General Groves [British military advisor] was very bucked about this. Hitherto, his has been a voice crying in the wilderness. Today he repeated his former predictions and made our hair stand on end by telling us what would happen if the Germans suddenly attacked London and Paris with 5,000 aeroplanes loaded with high explosives and poison bombs.[6]

Illegal manufacture of aircraft was not a result of any efforts by the German Republican Government. But the stimulation of air commerce by means of liberal subsidization, thus increasing Germany's air potential for eventual rearmament when the political climate both at home and abroad would sanction such an effort, was a conscious policy of the Weimar Government in air matters.

Under Article Seven of the Federal Constitution, the Weimar Republic had the power to legislate on "motor traffic on land, on water, and in the air, and on the construction of highways for the general traffic or for the defense of the Reich." In accordance with the historic participation of the Reich in the development of canals, railroads, and maritime transport, the Weimar Republic went all out in promoting commercial air transportation. The maintenance of an expensive military air force, a substantial portion of aviation expenditure in all other major nations, was prohibited to Germany. The first comprehensive basic law of aviation was the Air Traffic Act of 1922 passed by the Reichstag which formalized the existance of the *Luftamt* (Air Office) created by a Presidential Order of September 1, 1920.[7] Under this law, general powers of supervision with limited power of control were delegated to the *Luftamt* of the Transport Ministry. The responsibility for submitting periodic reports and statistics on German air transportation to the Allied Powers enforcing the peace was held by the *Luftamt*. The acquisition of knowledge about all aviation activity within Germany was efficiently performed.

Under the capable direction of Ernst Brandenberg, the *Luftamt* quickly assumed central importance in German aviation. It was to serve as the fount of equipment and postal subsidies to the aircraft industry and commercial airlines, as well as the directing agency for what secret steps were taken towards rearmament. Brandenberg, an ex-Army Captain, was appointed to his post upon the initiative of General Hans von Seeckt, Chief of the *Reichswehr*, and was, of course, entirely sympathetic to Germany's defenseless

[6] Entry of January 23, 1921, *Lord Riddell's Intimate Diary of the Peace Conference and After, 1918-1923* (New York: 1934), pp. 269-70.

[7] *Reichsgesetzblatt* (1922), I, p. 691.

military posture.[8] Through his official relation with all of German aviation, Brandenberg was able to establish pilot training programs, to maintain technical research and development, to stimulate air-mindedness in influential government circles as well as among the German populace, and to encourage political and diplomatic action furthering Germany's strategic position with regard to air matters.

In January 1923, aerial sovereignty in nonmilitary affairs was restored to Germany in accordance with the peace terms.[9] This restoration of Germany's political power in the air coincided with the occupation of the Ruhr basin by French troops to extract defaulted reparations by force from Germany. Though reoccupied by foreign troops, the Weimar Republic immediately retaliated for the French action by excluding the commercial aircraft of the Allied Powers from operations in and over Germany. Most historians have ignored the significance of the aerial aspects of the great difficulties which arose from these circumstances. When the *Compagnie Franco-Roumaine* airline attempted to continue nonstop flights from France to Prague across German territory, all French aircraft forced down by weather or mechanical failure in German territory were confiscated by the German Government. The French could only object since Germany possessed sovereignty over its own airspace. Existing French concern that German transports were potential bombers was highly stimulated. At the conclusion of a forum at the Sorbonne on October 31, 1923 on the subject of "*Lé Danger Aérien Allemand*," the following telegram was dispatched to Premier Poincare:

> Three thousand patriots, assembled under the presidency of General de Castelnau, convinced of the absolute uselessness of German aeronautics in the German economic situation, convinced of the peril to France contained in German aviation, verifying the extent of German aeronautical development as publicly denounced by M. Poincare, congratulate the Prime Minister on his clear-sightedness and express to him their entire confidence, persuaded as they are, that he will not fail to forbid to Germany her aviation for as long a time as she shall not have paid her debt to France.[10]

So many French aircraft were forced down in a particular area of the Rhineland that many French newspaper accounts intimated that Germany had devised and was employing a "secret ray" which could stop aircraft motors. These reports aroused great concern in international intelligence circles.[11] It was later discovered that the failure of the French aircraft engines was due to a specific magneto defect which appeared after a certain period of engine operation. But France, the nation which most vigorously enforced the peace terms in promoting its strategic security and had disarmed the least of any nation, was eventually forced to conclude a bilateral air convention with Germany in 1926. This allowed French airlines to renew their schedules to Prague. This was also *de jure* recognition by France of the *de facto* situation—Germany, under the peace terms, controlled its own airspace.

The creation of *Lufthansa* was a

[8] Cf. F. von Rabenau, *Seeckt: Aus Seinem Leben* (Leipzig: 1941), p. 530.

[9] For German analysis of Germany's position with regard to international air law, see Werner Bartz, *Deutsche Luftrechtspolitik seit Versailles* (Berlin: 1927).

[10] Cf. "Lé Danger Aérien Allemand," *L'Echo de Paris* (1923), p. 30.

[11] See Grey, pp. 91-92.

stellar development in the renaissance of German air power. Because of concerted *Luftamt* effort, all of Germany's commercial airlines were consolidated by 1926 into one centralized state-controlled instrument. In the fall of 1923, the *Luftamt* withheld airline subsidies in this worst hour of the German inflation, and then paid them in October at a rate equivalent to that prevailing in 1922. The smaller airlines with insufficient capital reserves were forced by the astronomic inflation and the withheld subsidies to merge with larger corporations. By the end of 1923, two highly competitive airlines had emerged in Germany: *Junkers Luftverkehr* (controlling seventeen companies); and *Deutscher Aero Lloyd* (controlling seven). These rival combines were threatened with complete withdrawal of subsidies unless they merged. *Lufthansa* was formed on January 1, 1926, and its managing director was Erhard Milch, later Deputy Air Minister under Hermann Goering. During this year of Locarno Treaty and Germany's entrance into the League of Nations, German airlines flew more miles and carried more passengers, mail and freight, than the airlines of any two other European nations combined. All European air routes led to Berlin. This was eloquent testimony to the Reich's central location on the continent, its sovereignty on air matters of a nonmilitary nature, the efficiency of the *Luftamt* in promoting Germany's air potential and, in effect, the unsuccessful consequences of the peacemakers' attempt to regulate only the purely military features of Germany's air power.

It was not an exaggeration for Hermann Goering as Nazi Air Minister to look back and declare that "*Lufthansa* was the stronghold of the *Luftwaffe* spirit during the years of darkness." Popular enthusiasm for civil and commercial aviation during the late 1920's, assisted by widespread publicity as well as governmental subsidies, made Germany one of the most air-minded nations. University professors, students, and government officials were, for example, encouraged to travel by air by means of the device of reduced fares. When *Lufthansa's* subsidies were slashed in half by the Reichstag in 1928, the political influence of the state-rationalized airline was such that most of its subsidies were restored. It was during this subsidy crisis that Milch met Goering. *Lufthansa,* moreover, shared in the world-wide growth of international air transport. By 1932 it had scheduled operations blanketing almost the whole of Central Europe with routes extending to Moscow, Barcelona and Salonika. It had a joint-stock company with the Russians in *Deruluft* and with the Chinese in *Eurasia.* Air routes to German-developed airlines in South America, several of which became *Lufthansa* subsidiaries, were thoroughly surveyed in the 1920's and the *Graf Zeppelin* made its dramatic "propaganda flights" over the South Atlantic in 1929. While world attention had been captivated by the transatlantic aviators and other spectacular manifestations of technical progress in aviation by the early 1930's, German air-mindedness not only possessed an element of intrinsic nationalistic pride for the proficiency of *Lufthansa's* expansion into the international field, but it was also politically oriented. A semi-official history of *Lufthansa* trumpeted the classic slogans which had spurred maritime expansion in the 19th century, such as "commerce follows the flag" and "civilization follows transportation." Its enthusiastic author even predicted that *Lufthansa* would have to play a prominent role in the forthcoming political and economic

conflict for German freedom on the world's airways.[12]

The prodigious development of German commercial aviation between 1923 and 1933 assisted the creation of two significant impressions widely held about German air power and subsequently greatly conditioned world opinion regarding air power as a diplomatic influence during the Nazi era. First, it preserved and exaggerated the myth that transport aircraft armed with bombs were effective bombing aircraft. This thorny problem plagued the control of German aviation by the peacemakers and helped confound disarmament efforts. It assisted Germany's position when it abruptly departed from the League of Nations, and it continuously aggravated delicate Franco-German animosities on all military questions. Secondly, *Lufthansa's* notable growth lent substance to well-founded views that civil and commercial aviation provided potential military and political strength to Germany. Not the least of the political results of this was the later exploitation of German aviation developments as a moral victory over the *Versailles Diktat.*

MILITARY AIR DOCTRINE

The clandestine efforts devoted to aerial rearmament and theoretical planning in Republican Germany deserves some attention to place it in proper historic perspective. It has been greatly exaggerated in most history books. When Germany's first military air force was swept into the defeat of 1918 and the revolutionary situation in Germany proper, any German aerial threat to the supremacy of Allied arms disappeared long before actual disarmament was instituted by the victors. The last commander of the famed *Richthofen Geschwader,* Hermann Goering, heroically led the entire squadron in a final flight back into Germany rather than surrender their aircraft to the Allies. German pilots with their aircraft later appeared in the Baltic where they took part in the sporadic fighting there.[13] But for all practical purposes the German Air Force disintegrated after November 1918. The rationalization of defeat and the distillation of a tradition of heroism was, however, well evidenced. General Ernst von Hoeppner, commanding general of the air forces during the war, dedicated his memoirs as follows:

> I dedicate this book to the German air forces, to the air forces that came into existence during the war, that grew and increased to an enormous power, that to the last day did their work, far away in the countries of the enemy, unvanquished, feared and admired by the enemy, a threatening cloud, a sharp eye and a sure shield on every frontier, to the air forces that once upon a time existed but are no more. . . .
>
> In the present confusion the sense of German heroism has disappeared, our strong sword, the pillar of our might, has been broken. The will of our enemies, through revenge and fear, have reduced our land and sea power to the smallest possible limit and have destroyed our air power completely.
>
> Still, although the tree may be cut down, the taproot is still alive and the day is bound to come, when the tree will grow again and will bear flowers and fruit once more. That

[12] Wolf Bley, *Deutsche Luft Hansa A.-G.* (Berlin: 1932), pp. 12-14. Cf. O. J. Lissitzyn, *International Air Transport and National Policy* (New York: 1942), pp. 56-67, 120-21, 181-83, 337-39; and Wm. A. Burden, *Struggle For Airways in Latin America* (New York: 1943).

[13] *Deutschlands Krieg in der Luft* (Leipzig: 1921), p. iii.

will be the time when the German air fleet reawakens to the honor and to the protection of the entire German people.

The "stab-in-the-back" legend of Germany's defeat and the view that the peace treaty was a weapon of the victor's oppression—these became the arguments of German military leaders to promote class-warfare against the Socialist Government and to justify illicit rearmament.

In the many academic discussions on military strategy in defeated Germany, the lessons of the war experience dictated that the stagnant trench warfare in the West and the problem of mobility on the Russian front had to be clearly solved in any future war. Defeat in war is always a clearer future consequence to avoid to those who have been most recently defeated. In view of Germany's defenseless position —a treaty Army limited to 100,000 effectives and expressly denied an air force—German strategists and planners were not only completely free to theorize fully on the role of aircraft in modern war, but also were free to establish the basis for the genesis of a new Air Force. The Treaty of Versailles thus served as the womb of the *Luftwaffe*.

Midwife of German air strategy between the World Wars was General Hans von Seeckt, Chief of the Reichswehr.[14] This fact has not been fully appreciated. In his final order of the day dissolving the old air force on May 5, 1920, Seeckt said: "We shall never abandon hope of one day possessing a new air force." In spirit and by deed, Seeckt instilled among all students of military strategy in the German Army a sound appreciation for the influence of technical progress upon modern warfare. He stressed the importance of moral and economic strength in preventing another disaster like 1918. Although he was far from being an advocate of the strategical use of air forces according to Douhet or Trenchard, Seeckt was far ahead of his opposite numbers abroad in his recognition of the importance of air forces to army strategy. He formulated with considerable logic that the first objective of an air force in war was to destroy the opposing air force. He stated:

> In a few words, the whole future of warfare appears to me to lie in the employment of mobile armies, relatively small but of high quality, and rendered distinctly more effective by the addition of aircraft, and in the simultaneous mobilization of the whole defense force, be it to feed the attack or for home defense.[15]

Seeckt, moreover, had rare appreciation for political aspects of national military strategy when he said: "The statement that war is a continuation of policy by other means has become a catch phrase, and is therefore dangerous. We can say with equal truth —war is the bankruptcy of policy." He proved prophetic in his remarks that whenever the acquisition of power for its own sake became the prime objective of a nation's strategy:

> The statesman will soon find himself thwarted in some way or other, will deduce from this opposition a menace first to his plans, then to

[14] During the war Seeckt has distinguished himself on the fluid battle fronts in Russia rather than in the trenches in France, and had well absorbed an appreciation for mobility in the tradition of Moltke and Schlieffen. His biographer states that Seeckt "not only reoriented all training in accordance with a war of movement and so established the supremacy of the attack over defense, but what was equally important, he practically obviated all useless controversy on the problem. Cf. Rabenau, p. 505; B. H. Liddell Hart, *The German Generals Talk* (New York: 1948), pp. 10-19.

[15] *Thoughts of a Soldier* (London: 1930), p. 62.

national prestige, and finally to the existence of the state itself—and so, regarding his country as the party attacked, will engage in a war of defense.[16]

Seeckt's ideas had a lasting impact upon German military thought. His concepts with regard to a military air force were assured partial fruition by the policies he instituted. A "brain cell" of three air officers, later expanded to fifteen, were immediately instituted in the *Truppen-Amt*, which became the substitute for the treaty-forbidden General Staff and which Seeckt commanded before becoming head of the Reichswehr. Among officers assigned to this brain cell were Wever, Wilberg, Kesselring, Wimmer, Sperrle, and others who were subsequently to head important directorates of the *Luftwaffe* once the Nazis lifted the lid off all out rearmament. Importantly, these men were not airmen, but regular Army officers who later learned to fly in mid-career.

Consistent with Seeckt's program for the entire *Reichswehr*, the central feature of early 1920 staff planning for aviation was the desire to create an embryonic air force which could be expanded once political conditions permitted. After the French occupation of the Ruhr in 1923, Seeckt was convinced that purely theoretical maintenance of a modern military force was not enough. A secret aviation section, known as *Fliegerzentrale*, was created to direct activities increasing the military potential of German aviation. It was commanded first by Wilberg, later by Hugo Sperrle. Under a cloak of binding secrecy, *Reichswehr* officers were provided flight training in civil air sports and later *Lufthansa* schools. Ex-wartime pilots were encouraged to be active members of the Aero Klub von Deutschland. These activities, among others, were coordinated fully with Ernst Brandenberg of the Air Office of the Transport Ministry.

After 1927, actual military flight training and war games were conducted in the Soviet Union by German airmen. These officers were rotated on the retired list available to Allied Military Control inspectors. The arrangement with Communist Russia had been worked out by Seeckt in the early 1920's.[17] The several hundred selected officers trained in Russia later occupied the majority of the highest ranks in the *Luftwaffe* officer corps. The military worthlessness of civil aircraft constructed so they could quickly be converted to military planes, was early learned by the *Fliegerzentrale*. Military prototypes were secretly developed, some of them outside of Germany. Air tactics and armaments, in accordance with theoretical planning, were tested on a limited scale within Germany itself at a proving ground established at Rechlin. In spite of all of these efforts, however, the secret steps toward German rearmament have been generally exaggerated. As Liddell Hart has properly cautioned:

> It is a historical mistake to overrate their [secret rearmament] steps in making possible Germany's renewed burst of aggression. The total effect was very slight, compared with the weight that Germany had to regain before she could again become a serious danger. The bulk of the material developments that really mattered was only achieved after Hitler had come to power.[18]

[16] Liddell Hart, pp. 17-18.

[17] See Hans W. Gatzke, "Russo-German Military Collaboration During the Weimar Republic," *American Historical Review*, April 1958; and E. H. Carr, *German-Soviet Relations Between Two World Wars* (Baltimore: 1952), pp. 55-66.

DOCTRINE AND POLITICS

After 1926, the "air-force-less" position of Germany in Europe increasingly became an important aspect of German efforts for a revision of the Treaty of Versailles. Field Marshal von Hindenberg, as will be recalled, became President of the Republic the year before Germany entered the League of Nations as a disarmed but sovereign equal. In December 1926, Social Democrats in the *Reichstag* revealed the *Reichswehr's* clandestine collaboration with the Soviet Union for the purpose of developing military aircraft, tactics, and training pilots. No serious curtailment of these activities resulted. Rather, the departure of the Allied Military Control Commissions in early 1927 offered the opportunity for increased but limited rearmament efforts within Germany itself. The world basked in the warmth of peace and prosperity.

During 1928, the construction of four "pocket battleships" permitted under the peace terms erected rearmament as an open political issue in Germany. General von Groener, *Reichswehr* Minister, addressed a confidential memorandum to cabinet members urging their support for the proposed construction, setting forth the necessity for military and naval forces strong enough to protect the neutrality of the Reich. With reference to a military air force, Groener's memorandum reflected *Reichswehr* thought on the purpose of an air force, as follows:

> In the event of war, a country which possesses strong bomber squadrons will not hesitate to attack the economic and administrative centers of any enemy country which does not possess an air force. The defenseless condition of the one country will prompt the aggressive instinct of the other.

Importantly, Groener insisted that if Germany possessed an adequate air force, "the would-be aggressor will give careful thought to the problem of whether the advantage accruing to him from an attack would outweigh the damage done to him by the reprisal raids he would have to expect."[19] In latter decades, this thought was called the "deterrent role of air power."

When articles in a popular literary magazine, *Die Weltbuehne* of March and April 1929, revealed many details concerning the secret air rearmament conducted in evasion of the Versailles prohibitions as well as overt Reich policy, Karl Ossietsky, its editor, was charged with high treason and eventually convicted of betraying vital military secrets.[20] *Reichswehr* policies for secret rearmament had now received the public sanction of the Republic's leadership. In 1929, Hermann Goering, as a junior member of the Reichstag, initiated his political career in German aviation by scoffing at the lack of a German air force in his speeches and conversations. Until now, Goering had done nothing in German aviation other than a brief try at selling parachutes. He flagrantly intimated in several speeches that once governmental power was in the hands of the Nazi Party (then a noisy but minor party) Germany's air position would be drastically improved.

By 1929, the tedious task of circum-

[18] Liddell Hart, pp. 13-14. For account of stimulating effect of the Versailles restrictions on weapon development in the field of rockets which culminated in the V-weapons, see Joseph Angell, "Guided Missiles Could Have Won," *Atlantic*, December 1951, pp. 30-31.

[19] Groener's memo became public knowledge in Germany after its publication in England in *The Review of Reviews*, January 1929.

[20] When Ossietsky received the Nobel Peace Prize in 1934, he was then held in a Nazi concentration camp.

venting Versailles had reached a point where further steps towards rearmament were limited under the aura of complete secrecy. In accordance with the teachings of Seeckt, many officers urged the open creation of a separate aviation echelon in the *Reichswehr*, and some even advocated the creation of an independent air force. Such a flagrant move bound to inflame world opinion, however, was bitterly opposed by most General Staff officers on purely military grounds. Such a step at this time might have been catastrophic for the entire rearmament program, had it become fully known to the German public as well as the rest of the world sunning in the false optimism for a permanent peace yet radiating from the League of Nations. Attempts were made, however, to consolidate all efforts in order to create an air force-in-embryo. This was done by increased exploitation of *Lufthansa* and civil aviation facilities and personnel. Theoretical bombing squadrons were created with *Lufthansa* transports and pilots, while various flying clubs were given military designations. Three so-called "Propaganda Air Squadrons" were established which flew throughout Germany at air shows and public demonstrations to create air-mindedness in general and to advertise an awareness of Germany's lack of a military air force.

By the latter days of the dying German Republic, the Air Section of the *Reichswehr* had created a conceptual framework of air strategy following the principles laid down by Seeckt. The doctrines popularized by Billy Mitchell and Guilio Douhet—the fundamental concept of an air force as an independent striking force, able to range beyond the battlefront over the homeland of the enemy—also captivated the air theorists of Germany. Upon the assumption that ever-improved aircraft were offensive weapons supreme, we endowed with the capacity for a su prise and decisive attack, the thoug was often expressed by German airme that the will of an enemy state cou be most quickly broken by str tegic air bombardment of populatio centers. Formulated purely on theoretical basis rationalized from Ge many's indefensible military position Europe, German views of air strateg differed from parallel concepts aire abroad only in their high degree refinement and in the serious vein which they were intellectually pursue

The awesome image of the "aeri menace" hanging over civilian popul tions clustered in cities was widely di cussed during preparatory sessio leading up to the World Disarmame Conference of 1932. German diplo matic representatives consistently pr posed the complete abolition of aeri bombardment and a clear-cut distin tion between "civilian" and "militar aircraft. Observing the lack of diplo matic influence in these and other i ternational discussions, German a theorists seem to have become ful appreciative of the intimate relatio ship between a nation's military pow and its diplomatic success, a factor lo illustrated by the enforcement of th air clauses of the peace terms.

CHALLENGE AND RESPONSE

As the air clauses of Versailles fail to control and served to stimulate Ge man civil aviation, so the prohibition an air force encouraged the broade theoretical study of air power as an i strument of policy among air-minde *Reichswehr* officers. In a top secr briefing before the Weapons Offi *(Waffenamt)* on February 18, 193 Major Wimmer, a prominent air of cer, tersely specified what Germa needed in the way of an air force

diminish the diplomatic frustrations apparent for Germany in international affairs. Wimmer stated:

> I have no doubt whatsoever regarding this: Only that nation and state will be in a position to negotiate which has a stronger air force, built upon an airplane which terrifies people day and night.[21]

In 1932, another member of the secret air planning staff, Rudolf Bogatsch, developed even further the strategic concept of utilizing the air force as a strategic weapon. He wrote as follows:

> Future wars will be total wars with the whole population of one country against the whole population of another. The means of combat belonging to the armies and navies will be supplemented by economic measures of the most varied kinds, by the use of the air arm and by the very extensive use of propaganda; many believe that the latter weapons, if effectively used at the proper time, may bring about a decisive victory.

At the world conference table in Geneva in 1932, Chancellor Bruening of the Weimar Republic made a desperate request for *de jure* recognition of Germany's right to possess a limited number of prototypes of prohibited weapons, such as military aircraft. He offered the view that unless genuine international disarmament as promised in the preamble of the Treaty of Versailles came about, or Germany was allowed to possess a sample air force, the republican form of government would not endure in Germany. This request of the German Chancellor was denied. The coming of Adolf Hitler to power in 1933 altered Germany's request for a sample air force to a demand for full military equality with other nations. The political basis for German rearmament, for which the strategists of the *Reichswehr* had long waited, now became existent under the Nazi Government. But the leaders of what became known as the "Third Reich" were to set forth the objectives and tasks of the new air force in German strategy, however, in an unforeseen manner. This next chapter on a treatment of the German "Third Reich's" contribution to the history of air power, must await a subsequent article.

[21] Reichsluftfahrtministerium, No. 4406-525, A. U. Library.

Two Firsts

First daily transcontinental air service was established April 17, 1926. This was also the first commercial air line of consequence. It was run in connection with the Los Angeles-Salt Lake Airway.—from *Touring Topics*, March 1933.

* * * *

First regularly scheduled air passenger line, not only in California but in the world, was established on July 4, 1919, when service was inaugurated between San Pedro and Catalina Island on the Chaplin Air Line. The *Seagull* took off at five o'clock in the morning, attracting wide attention.—Rockwell D. Hunt.—from *Touring Topics*, February 1933.

LIQUID-PROPELLANT ROCKET DEVELOPMENT

By DR. ROBERT HUTCHINGS GODDARD—(1882-1945)

The father of modern rocketry is the American scientist, Dr. Robert Hutchings Goddard (1882-1945) of Clark University, who devoted a lifetime to rocket and missile research. In 1918 he developed the idea for the famed bazooka *of World War II fame. By 1926 Goddard had constructed and tested successfully the first rocket motor using liquid fuels. Indeed, this test on March 16, 1926 at Auburn, Massachusetts, was a feat almost as epochal as that of the Wright brothers at Kitty Hawk. As primitive in its day as the Wrights' achievement, Goddard, like the Wrights, could make no impression upon disinterested government officials in seeking financial support for continued experimentation. This was, as is well-known, in severe contrast to those in Germany who recognized Goddard's pioneering achievement in translating theories into test-stand realities. Eighteen years later, Goddard's principles came to life in the German V-2 rockets.*

The article below is Dr. Goddard's own account of his rocket experiments. It is the substance of his report to the Daniel and Florence Guggenheim Foundation concerning rocket development carried out under his direction in Roswell, New Mexico, from July 1930 to July 1932, and from September 1934 to September 1935, supported by this Foundation. It was originally published by the Smithsonian Institution in its Miscellaneous Collection *(Pub. 3381), vol. 95, No. 3, March 16, 1936.*

Dr. Goddard was born at Worcester, Massachusetts, October 5, 1882; received his Bachelor of Science degree from Worcester Polytechnic Institute in 1908, and taught physics at his alma mater as well as at Princeton from 1912 until 1919. He then moved to Clark University where he served until 1943. He was Director of Research, Bureau of Aeronautics, Navy Department, from 1942 until 1945. In addition, he was a consulting engineer for Curtiss-Wright Corporation from 1943 to 1945. Death terminated his active career on August 10, 1945,—four days after the first atom bomb was dropped on Japan.

In a previous paper[1] the author developed a theory of rocket performance and made calculations regarding the heights that might reasonably be expected for a rocket having a high velocity of the ejected gases and a mass at all times small in proportion to the weight of propellant material. It was shown that these conditions would be satisfied by having a tapered nozzle through which the gaseous products of combustion were discharged,[2] by feeding successive portions of propellant material into the rocket combustion chambers,[3] and further by employing a series of rockets, of decreasing size, each fired when the rocket immediately below was empty of fuel. Experimental results with powder rockets were also presented in this paper.

Since the above was published, work has been carried on for the purpose of making practical a plan of rocket propulsion set forth in 1914[3] which may be called the liquid-propellant type of rocket. In this rocket, a liquid

[1] Smithsonian Misc. Coll., vol. 71, no. 2, 1919.

[2] U.S. Patent, Rocket Apparatus, No. 1,102,653, July 7, 1914.

[3] U.S. Patent, Rocket Apparatus, No. 1,103,503, July 14, 1914.

fuel and a combustion-supporting liquid are fed under pressure into a combustion chamber provided with a conical nozzle through which the products of combustion are discharged. The advantages of the liquid-propellant rocket are that the propellant materials possess several times the energy of powders, per unit mass, and that moderate pressures may be employed, thus avoiding the weight of the strong combustion chambers that would be necessary if propulsion took place by successive explosions.

Expermients with liquid oxygen and various liquid hydrocarbons, including gasoline and liquid propane, as well as ether, were made during the writer's spare time from 1920 to 1922, under a grant by Clark University. Although oxygen and hydrogen, as earlier suggested,[4] possess the greatest heat energy per unit mass, it seems likely that liquid oxygen and liquid methane would afford the greatest heat value of the combinations which could be used without considerable difficulty. The most practical combination, however, appears to be liquid oxygen and gasoline.

In these experiments it was shown that a rocket chamber and nozzle, since termed a "rocket motor," could use liquid oxygen together with a liquid fuel, and could exert a lifting force without danger of explosion and without damage to the chamber and nozzle. These rockets were held by springs in a testing frame, and the liquids were forced into the chamber by the pressure of a noninflammable gas.

The experiments were continued from 1922 to 1930, chiefly under grants from the Smithsonian Institution. Although this work will be made the subject of a later report, it is desirable in the present paper to call attention to some of the results obtained. On November 1, 1923, a rocket motor operated in the testing frame, using liquid oxygen and gasoline, both supplied by pumps on the rocket.

In December 1925 the simpler plan previously employed of having the liquids fed to the chamber under the pressure of an inert gas in a tank on the rocket was again employed, and the rocket developed by means of these tests was constructed so that it could be operated independently of the testing frame.

The first flight of a liquid oxygen-gasoline rocket was obtained on March 16, 1926, in Auburn, Massachusetts, and was reported to the Smithsonian Institution May 5, 1926. Pressure was produced initially by an outside pressure tank, and after launching by an alcohol heater on the rocket.

It will be seen from the photograph that the combustion chamber and nozzle were located forward of the remainder of the rocket, to which connection was made by two pipes. This plan was of advantage in keeping the flame away from the tanks, but was of no value in producing stabilization. This is evident from the fact that the direction of the propelling force lay along the axis of the rocket, and not in the direction in which it was intended the rocket should travel, the condition therefore being the same as that in which the chamber is at the rear of the rocket. The case is altogether different from pulling an object upward by a force which is constantly vertical, when stability depends merely on having the force applied above the center of gravity. The rocket traveled a distance of 184 feet in 2.5 seconds, as timed by a stop watch, making the speed along the trajectory about 60 miles per hour.

[4] Smithsonian Misc. Coll., vol. 71, no. 2, 1919.

Other short flights of liquid oxygen-gasoline rockets were made in Auburn, that of July 17, 1929, happening to attract public attention owing to a report from someone who witnessed the flight from a distance and mistook the rocket for a flaming airplane. In this flight the rocket carried a small barometer and a camera, both of which were retrieved intact after the flight. The combustion chamber was located at the rear of the rocket, which is, incidentally, the best location, inasmuch as no part of the rocket is in the high velocity stream of ejected gases, and none of the gases are directed at an angle with the rocket axis.

During the college year 1929-30 tests were carried on at Fort Devens, Massachusetts, on a location which was kindly placed at the disposal of the writer by the War Department. Progress was made, however, with difficulty, chiefly owing to transportation conditions in the winter.

At about this time Colonel Charles A. Lindbergh became interested in the work and brought the matter to the attention of the late Daniel Guggenheim. The latter made a grant which permitted the research to be continued under ideal conditions, namely, in eastern New Mexico; and Clark University at the same time granted the writer leave of absence. An additional grant was made by the Carnegie Institution of Washington to help in getting established.

It was decided that the development should be carried on for 2 years, at the end of which time a grant making possible 2 further years' work would be made if an advisory committee, formed at the time the grant was made, should decide that this was justified by the results obtained during the first 2 years. This advisory committee was as follows: Dr. John C. Merriam, chairman; Dr. C. G. Abbot; Dr. Walter S. Adams; Dr. Wallace W. Atwood; Colonel Henry Breckinridge; Dr. John A. Fleming; Colonel Charles A. Lindbergh; Dr. C. F. Marvin; and Dr. Robert A. Millikan.

The Establishment In New Mexico

Although much of the eastern part of New Mexico appeared to be suitable country for flights because of clear air, few storms, moderate winds, and level terrain, it was decided to locate in Roswell, where power and transportation facilities were available.

A shop 30 by 55 feet was erected in September 1930, and the 60-foot tower previously used in Auburn and Fort Devens was erected about 15 miles away. A second tower, 20 feet high, was built near the shop for static tests, that is, those in which the rocket was prevented from rising by heavy weights, so that the lift and general performance could be studied. These static tests may be thought of as "idling" the rocket motor. A cement gas deflector was constructed under each tower, whereby the gases from the rocket were directed toward the rear, thus avoiding a cloud of dust which might otherwise hide the rocket during a test.

Static Tests Of 1930-32

Although, as has been stated, combustion chambers had been constructed at Clark University which operated satisfactorily, it appeared desirable to conduct a series of thorough tests in which the operating conditions were varied, the lift being recorded as a function of the time. Various modifications in the manner of feeding the liquids under pressure to the combustion chamber were tested, as well as variations in the proportions of the liquids, and in the size and shape of the chambers. The chief conclusions reached were that satisfactory opera-

tion of the combustion chambers could be obtained with considerable variation of conditions, and that larger chambers afforded better operation than those of smaller size.

The supporting frame for the rocket was held down by four steel barrels containing water. Either two or four barrels could be filled, and in the latter case the total weight was about 2,000 lbs. This weight was supported by a strong compression spring, which made possible the recording of the lift on a revolving drum driven by clockwork.

The combustion chamber finally decided upon for use in flights was 5¾ inches in diameter and weighed 5 pounds. The maximum lift obtained was 289 pounds, and the period of combustion usually exceeded 20 seconds. The lifting force was found to be very steady, the variation of lift being within 5 percent.

The masses of liquids used during the lifting period were the quantities most difficult to determine. Using the largest likely value of the total mass of liquids ejected and the integral of the lift-time curve obtained mechanically, the velocity of the ejected gases was estimated to be over 5,000 feet per second. This gave for the mechanical horsepower of the jet 1,030 h.p., and the horsepower per pound of the combustion chamber, considered as a rocket motor, 206 h.p. It was found possible to use the chambers repeatedly.

The results of this part of the development were very important, for a rocket to reach great heights can obviously not be made unless a combustion chamber, or rocket motor, can be constructed that is both extremely light and can be used without danger of burning through or exploding.

Flights During The Period 1930-32

The first flight obtained during this period was on December 30, 1930, with a rocket 11 feet long, weighing 33.5 pounds. The height obtained was 2,000 feet, and the maximum speed was about 500 miles per hour. A gas pressure tank was used on the rocket to force the liquid oxygen and the gasoline into the combustion chamber.

In further flights pressure was obtained by gas pressure on the rocket, and also by pumping liquid nitrogen through a vaporizer, the latter means first being employed in a flight on April 19, 1932.

In order to avoid accident, a remote control system was constructed in September 1931, whereby the operator and observers could be stationed 1,000 feet from the tower, and the rocket fired and released at will from this point. This arrangement has proved very satisfactory.

One observer was stationed 3,000 feet from the tower, in the rear of the 1,000-foot shelter, with a recording telescope. Two pencils attached to this telescope gave a record of the altitude and azimuth, respectively, of the rocket, the records being made on a paper strip, moved at a constant speed by clockwork. The sights at the front and rear of the telescope, similar to those on a rifle, were used in following the rocket when the speed was high. This device proved satisfactory except when the trajectory of the rocket was in the plane of the tower and the telescope. For great heights, short-wave radio direction finders, for following the rocket during the descent, will be preferable to telescopes.

During this period a number of flights were made for the purpose of testing the regulation of the nitrogen gas pressure. A beginning on the problem of automatically stabilized vertical flight was also made, and the

first flight with gyroscopically controlled vanes was obtained on April 19, 1932, with the same model that employed the first liquid nitrogen tank. The method of stabilization consisted in forcing vanes into the blast of the rocket[5] by means of gas pressure, this pressure being controlled by a small gyroscope.

As has been found by later tests, the vanes used in the flight of April 19, 1932, were too small to produce sufficiently rapid correction. Nevertheless, the two vanes which, by entering the rocket blast, should have moved the rocket back to the vertical position were found to be warmer than the others after the rocket landed.

This part of the development work, being for the purpose of obtaining satisfactory and reproducible performance of the rocket in the air, was conducted without any special attempt to secure great lightness, and therefore great altitudes.

In May 1932 the results that had been obtained were placed before the advisory committee, which voted to recommend the 2 additional years of the development. Owing to the economic conditions then existing, however, it was found impossible to continue the flights in New Mexico.

A grant from the Smithsonian Institution enabled the writer, who resumed full-time teaching in Clark University in the fall of 1932, to carry out tests that did not require flights, in the physics laboratories of the University during 1932-33, and a grant was received from the Daniel and Florence Guggenheim Foundation which made possible a more extended program of the same nature in 1933-34.

Resumption Of Flights In New Mexico

A grant made by the Daniel and Florence Guggenheim Foundation in August 1934, together with leave of absence for the writer granted by the Trustees of Clark University, made it possible to continue the development on a scale permitting actual flights to be made. This was very desirable, as further laboratory work could not be carried out effectively without flights in which to test performance under practical conditions.

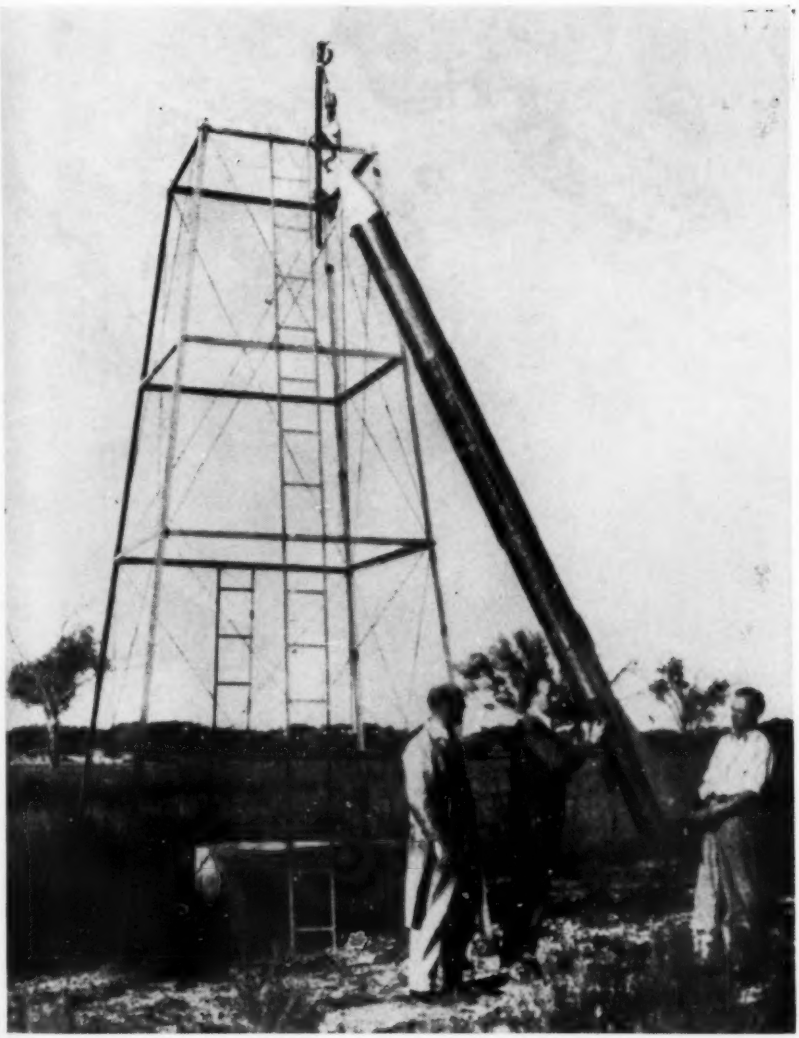
Work was begun in September 1934, the shop being put in running order and the equipment at the tower for the flights being replaced. The system of remote control previously used was further improved and simplified, and a concrete dugout was constructed 50 feet from the launching tower in order to make it possible for an observer to watch the launching of the rocket at close range.

Development Of Stabilized Flight

It was of the first importance to perfect the means of keeping the rockets in a vertical course automatically, work on which was begun in the preceding series of flights, since a rocket cannot rise vertically to a very great height without a correction being made when it deviates from the vertical course. Such correction is especially important at the time the rocket starts to rise, for a rocket of very great range must be loaded with a maximum amount of propellant and consequently must start with as small an acceleration as possible. At these small initial velocities fixed air vanes, especially those of large size, are worse than useless, as they increase the deviations due to the wind. It should be remarked that fixed air vanes should preferably be small, or dispensed with entirely, if automatic stabilization is employed, to minimize air resistance.

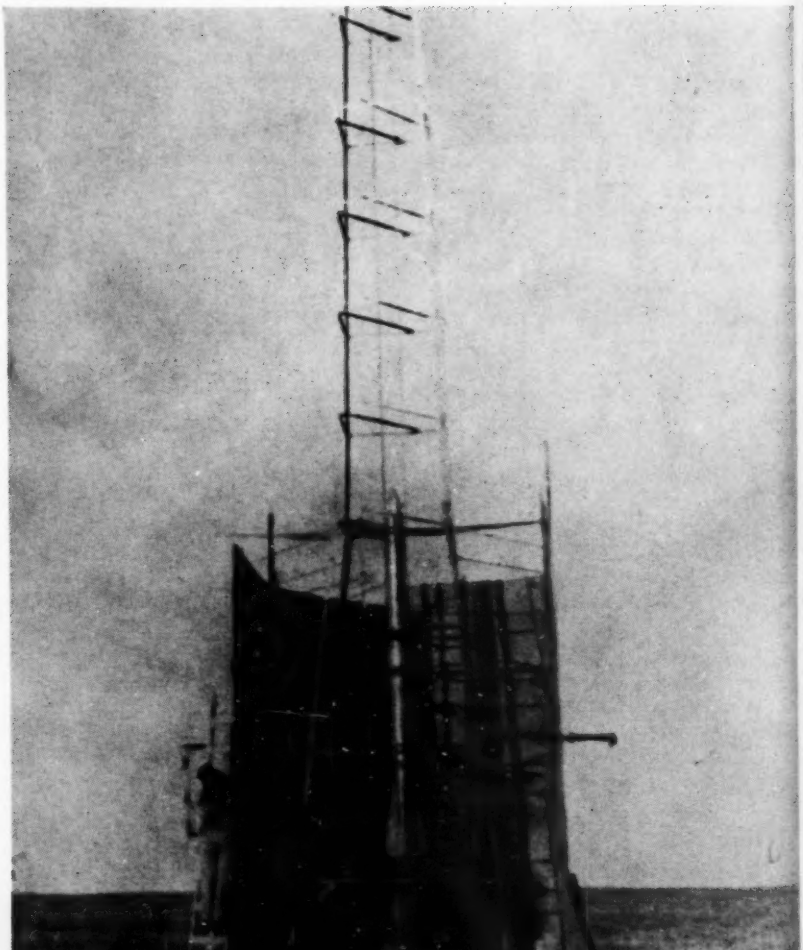
In order to make the construction of the rockets as rapid as possible,

[5] U.S. Patent, Mechanism for Directing Flight, No. 1,879,187, September 27, 1932.



Shown in its primitive launching platform is the rocket of the flight of March 28, 1935. The steel tower was sixty feet high. The gyroscope and directing vanes were tested before each flight by inclining and rotating the rocket suspended from the tower.

combustion chambers were used of the same size as those in the work of 1930-32, together with the simplest means of supplying pressure, namely, the use of a tank of compressed nitrogen gas on the rocket. The rockets were, at the same time, made as nearly streamline as possible without resorting to special means for forming the jacket or casing.



Note the similarity of configuration of Dr. Goddard's rocket in 1935 as compared to today's rockets. This is a photo of the rocket being readied for flight near Alamogordo, New Mexico on March 28, 1935. On this flight the rocket attained a maximum of 550 miles per hour.

Pendulum Stabilizer

A pendulum stabilizer was used in the first of the new series of flights to test the directing vanes, for the reason that such a stabilizer could be more easily constructed and repaired than a gyroscope stabilizer, and would require very little adjustment. A pendu-

lum stabilizer could correct the flight for the first few hundred feet, where the acceleration is small, but it would not be satisfactory where the acceleration is large, since the axis of the pendulum extends in a direction which is the resultant of the acceleration of the rocket and the acceleration of gravity, and is therefore inclined from the vertical as soon as the rocket ceases to move in a vertical direction. The pendulum stabilizer, as was expected, gave an indication of operating the vanes for the first few hundred feet, but not thereafter. The rocket rose about 1,000 feet, continued in a horizontal direction for a time, and finally landed 11,000 feet from the tower, traveling at a velocity of over 700 miles per hour near the end of the period of propulsion, as observed with the recording telescope.

Gyroscope Stabilizer

Inasmuch as control by a small gyroscope is the best as well as the lightest means of operating the directing vanes, the action of the gyroscope being independent of the direction and acceleration of the rocket, a gyroscope having the necessary characteristics was developed, after numerous tests.

The gyroscope was set to apply controlling force when the axis of the rocket deviated 10° or more from the vertical. In the first flight of the present series of tests with gyroscopic control, on March 28, 1935, the rocket as viewed from the 1,000-foot shelter traveled first to the left and then to the right, thereafter describing a smooth and rather flat trajectory. This result was encouraging, as it indicated the presence of an actual stabilizing force of sufficient magnitude to turn the rocket back to a vertical course. The greatest height in this flight was 4,800 feet, the horizontal distance 13,000 feet, and the maximum speed 550 miles per hour.

In subsequent flights, with adjustments and improvements in the stabilizing arrangements, the rockets have been stabilized up to the time propulsion ceased, the trajectory being a smooth curve beyond this point. In the rockets so far used, the vanes have moved only during the period of propulsion, but with a continuation of the supply of compressed gas the vanes could evidently act against the slip stream of air as long as the rocket was in motion in air of appreciable density. The oscillations each side of the vertical varied from 10° to 30° and occupied from 1 to 2 seconds. Inasmuch as the rockets started slowly, the first few hundred feet of the flight reminded one of a fish swimming in a vertical direction. The gyroscope and directing vanes were tested carefully before each flight, by inclining and rotating the rocket while it was suspended from the 20-foot tower.

The continually increasing speed of the rockets, with the accompanying steady roar, make the flights very impressive. In the two flights, the rocket left a smoke trail and had a small, intensely white flame issuing from the nozzle, which at times nearly disappeared with no decrease in roar or propelling force. This smoke may be avoided by varying the proportion of the fluids used in the rocket, but is of advantage in following the path of the rocket. The occasional white flashes below the rocket, seen in the photographs, are explosions of gasoline vapor in the air.

In the flight of October 14, 1935, the rocket rose 4,000 feet. In the flight of May 31, 1935, the rocket rose 7,500 feet. Photographs show the slow rise of the rocket from the launching tower, but do not show the very great increase in speed that takes place a few seconds

after leaving the tower, for the reason that the motion picture camera followed the rockets in flight.

A lengthwise quadrant of the rocket casing was painted red in order to show to what extent rotation about the long axis occurred in flight. Such rotation as was observed was always slow, being at the rate of 20 to 60 seconds for one rotation.

As in the flights of 1930-32 to study rocket performance in the air, no attempt was made in the flights of 1934-35 to reduce the weight of the rockets, which varied from 58 to 85 pounds. A reduction of weight would be useless before a vertical course of the rocket could be maintained automatically. The speed of 700 miles per hour, although high, was not as much as could be obtained by a light rocket, and the heights, also, were much less than could be obtained by a light rocket of the same power.

It is worth mentioning that inasmuch as the delicate directional apparatus functioned while the rockets were in flight, it should be possible to carry recording instruments on the rocket without damage or changes in adjustment.

Further Development

The next step in the development of the liquid-propellant rocket is the reduction of weight to a minimum. Some progress along this line has already been made. this work, when completed, will be made the subject of a later report.

Conclusion

The chief accomplishments to date are the development of a combustion chamber, or rocket motor, that is extremely light and powerful and can be used repeatedly, and of a means of stabilization that operates automatically while the rocket is in flight.

I wish to express my deep appreciation for the grants from Daniel Guggenheim, the Daniel and Florence Guggenheim Foundation, and the Carnegie Institution of Washington, which have made this work possible, and to President Atwood and the Trustees of Clark University for leave of absence. I wish also to express my indebtedness to Dr. John C. Merriam and the members of the advisory committee, especially to Colonel Charles A. Lindbergh for his active interest in the work and to Dr. Charles G. Abbot, Secretary of the Smithsonian Institution, for his help in the early stages of the development and his continued interest.

". . . the old clear-cut distinction between the states of "war" and "peace" is a thing of the past. At least for some years to come, the world will go on, as now, in a sort of curious twilight between war and peace. This does not mean, however, that we should in no circumstances engage in world war.

Recent history should prove that war is never prevented by running from it. There is a difference between a policy aimed at *preventing* war and one aimed at *avoiding* war. Before 1939, Britain and France tried to avoid war, and thus made it more certain.

To prevent war, we must make it unmistakably clear that, while we shall never adopt it as an instrument of policy, we are prepared to fight if our vital interests are threatened. . . ."—Sir John Slessor, Marshal of the Royal Air Force, in *Coronet*, December, 1954.

THE OFFENSIVE MINE LAYING CAMPAIGN AGAINST JAPAN

By THE NAVAL ANALYSIS DIVISION
U. S. Strategic Bombing Survey

One of the hitherto classified and highly significant documents about the war which began at Pearl Harbor is that which appears below. Through the recent efforts of the Editors, the following is the never-before-publicized substance of a report of the U. S. Strategic Bombing Survey (Pacific War), Naval Analysis Division, entitled, The Offensive Mine Laying Campaign Against Japan, *and dated 1 November 1946.*

President Harry S. Truman ordered the Bombing Survey in August 1945 to analyze the effects of all types of air attack in the war against Japan, submitting duplicate reports to the Secretary of War and the Secretary of the Navy. The 108 detailed reports which the USSBS submitted on the Pacific War were not, as many military students have forgotten, the labor of love of airmen. The officials of the Survey during its Japanese phase were: Franklin D'Olier, Chairman; Paul H. Nitze and Henry C. Alexander, Vice Chairman; and, Harry L. Bowman, J. Kenneth Galbraith, Rensis Likert, Frank A. McNamee, Jr., Fred Searls, Jr., Monroe E. Spaght, Lewis R. Thompson and Theodore P. Wright, Directors. These prominent civilian leaders were complemented by 300 civilian analysts, 350 officers and 500 enlisted men. The military segment was 60% Army and 40% Navy personnel. The reports of the USSBS were based upon the historical facts available after interrogating over 700 Japanese military, governmental and industrial officials, and translating tons of Japanese documents. Such timely and massive action in the cause of reliable historical analysis has not been paralleled before, or since.

The significance of the USSBS analysis of the American offensive mine laying campaign against Japan becomes obvious on reading it. Here is testimony of impeachable reliability which substantiates that American strategy in the Pacific War was based upon two faulty assumptions: (1) that a major naval engagement would decide the outcome of the Pacific War; and (2) that the occupation of the Japanese home islands would be necessary to achieve the surrender of Japan. Neither of these assumptions was confirmed by historical events.

PART I—INTRODUCTION

This report gives a summary and evaluation of the offensive mine laying attack against the Japanese during World War II. The campaign extended throughout most of the war. During this time, mines were laid from the homeland of Japan to the most remote areas of her acquired empire, claiming hundreds of ship casualties and producing widespread interference with her water-borne commerce. Mine laying was accomplished by Allied submarines, surface vessels, and aircraft. Particular emphasis is placed on the latter, since their use in this war was most extensive and produced such remarkable results.

PART II — GENERAL SUMMARY AND ACCOMPLISHMENTS

The mine laying attack against Japan sank or damaged over 2 million tons of enemy shipping, a volume representing

nearly one quarter of the prewar strength of the Japanese merchant marine. Combat vessels mined include 2 battleships, 2 escort carriers, 8 cruisers, 38 destroyers and destroyer escorts, 5 submarines and 54 other combatant vessels. Of these, 9 destroyers, 4 submarines and 36 auxiliary craft were sunk.

1. Inner Zone

More than 1,250,000 tons of shipping was sunk or damaged during the last 5 months of the war when the B-29s of the Twenty-first Bomber Comand executed an aerial mining blitz against enemy ports of the Inner Zone and the Shimonoseki Straits, the latter being a most vital artery for Japanese water-borne commerce. Mining brought about a virtual blockade of these Straits and all the important industrial ports on the Japanese Inland Sea. In addition, it caused a marked overall decrease in enemy shipping and severely handicapped movements of the Japanese Fleet.

This mine laying attack on the Inner Zone used approximately 12,000 mines and required only 5.7 percent of the Twenty-first Bomber Command's total effort. Out of 1,529 B-29 mining missions only 15 aircraft failed to return, a loss of less than 1 percent.[1]

Prince Konoye evaluated the aerial mining attack in the late stages of the war as having had an over-all economic effect comparable to the bombing and incendiary raids of the remaining 94.3 percent of the Twenty-first Bomber Command's effort. Leading Japanese industrialists and Imperial Japanese Naval Officers admit that the mining was one of the most serious problems which faced Japan during the closing months of conflict. It is significant that in the 5 months prior to the end of hostilities, mines sank or damaged more shipping than any other agent including submarine or direct air attack by both Army and Naval forces.[2]

2. Outer Zone

Prior to the final mining blockade of Japan and continuing with it, another widespread mine laying campaign was conducted in the enemy's Outer Zone. This attack commenced in the early months of the war and continued until the end. Submarines, surface vessels, and aircraft participated. Nearly 13,000 mines (of which more than 9,000 were aircraft types) were laid in over 150 harbors and ship lanes throughout the Outer Zone. Operations were carried out from China, India, Ceylon, Australia, and island bases in the South and Central Pacific. Although the concentration of mining was small because of the extensive area involved, the effect was large in proportion to the effort expended. Far-reaching results often came from small scale mining operations. After mining commenced, ports such as Rangoon and Haiphong were rarely used by large ships. Other ports such as Shanghai, Hong Kong, Takao, Bangkok, Singapore, Balikpapan, and Surabaya were frequently closed to enemy shipping by the threat of mines. Enemy bases such as Palau, Penang and Kavieng were abandoned shortly after, and

[1] "We agree that the mine warfare conducted by American planes during the Greater East Asia War produced a very great strategical effect. Particularly, after we lost Saipan, the minelaying raids of B-29s which used Saipan and Tinian as bases, coupled with the bombing raids on the home islands, quickly reduced our war potential and hastened the end of the war." Statement issued by conference of Japanese mine experts (released by USSBS).

[2] "The result of B-29 mining was so effective against the shipping that it eventually starved the country. I think you probably could have shortened the war by beginning earlier."—Capt. Kyuzo Tamaura, IJN — USSBS No. 26 (22 October 1945).

largely because of mining. General Chennault has credited mining of the Yangtze River and ports on the China Coast with having been one of the major factors contributing to the failure of the Japanese campaign in South China in 1944. Testimonies of Japanese military officials support this claim. Much of the enemy's failure to supply and reinforce his troops in Burma can be attributed to the persistent mining of ports in Burma, Siam, Malay, and Indochina.

In the Southwest Pacific Theater, 49 separate areas were mined by aircraft. This effort greatly interfered with Japanese attempts to exploit the Netherlands East Indies and supply their troops in the area. It is estimated that 40 percent of the enemy's shipping losses in the Netherland East Indies were caused by mines . . . .

3. Over-all Campaign

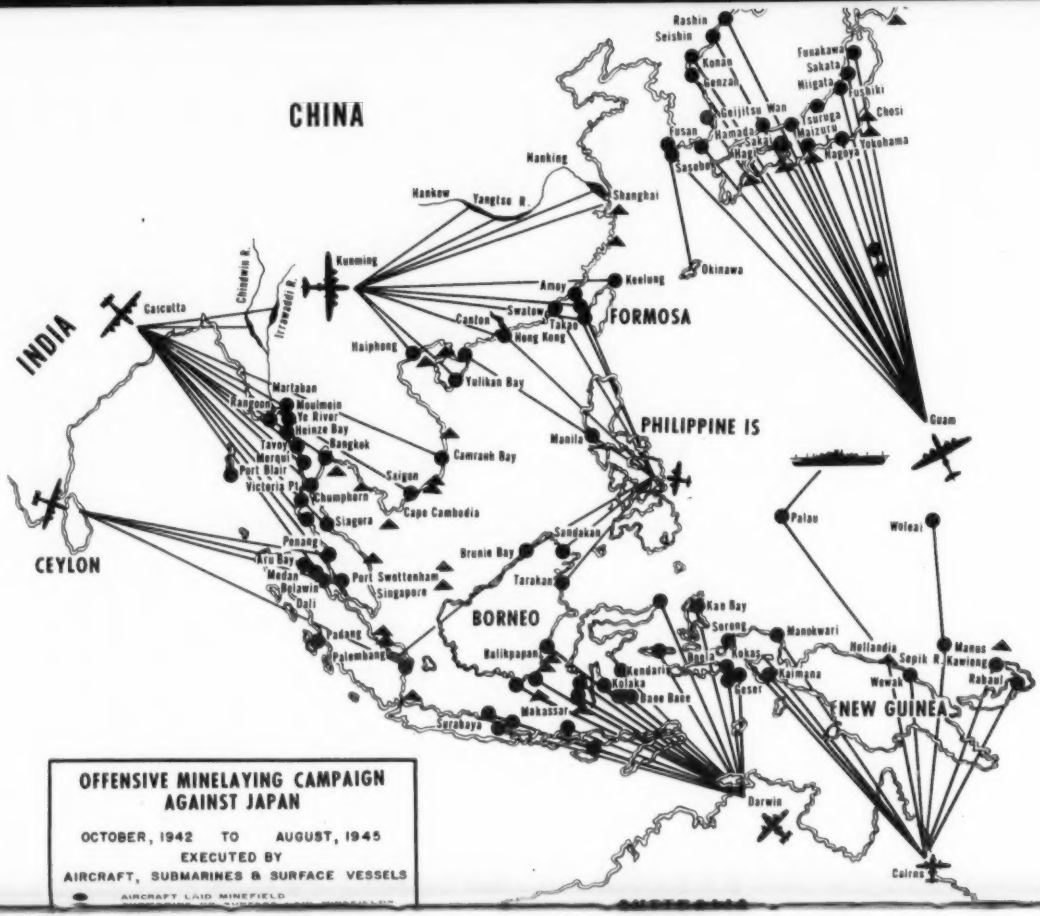
Considering the entire mining campaign in both the Inner and Outer Zones a total of nearly 25,000 offensive mines were laid against the Japanese. Of these, 21,389 were aircraft type laid during 4,760 sorties with a loss of but 55 planes. The effort and the cost were but an insignificant portion of the over-all war effort against Japan; still the results were proportionately very high.

In considering the accomplishments of the mine laying campaign, it should be recognized that ship losses are but incidental to the primary objects of mining which are to delay and disrupt the enemy's shipping, disorganize his maritime supply system, and thereby deprive him of essential military and economic materials. These latter effects cannot be evaluated directly as they are too closely integrated with results from all other forms of attack on transportation and shipping. Sufficient information is available, however, to indicate that mining made a significant contribution towards this end.

Another object of mining is to force upon the enemy the military and economic burden of maintaining a defense against it. This may require minesweeping or clearance, mine spotting, special treatment and modification of ships, and various measures to prevent minelaying operations. The enemy's concern for these matters was demonstrated by his degaussing of naval vessels and auxiliaries even though handicapped by serious shortages of electrical equipment and technical personnel. In the latter part of the war, antiaircraft guns were moved from important industrial cities to locations where they strengthened defenses in mining target areas. As a last resort numbers of scientific and technical personnel were diverted from other work to that of the development of mine countermeasures. By the end of the war, defense against mining was given top priority over all other defense measures in Japan.

This survey of the mining campaign has served to emphasize the fact that mining does not compete with, but is a very effective complement to direct submarine and air attack on shipping and strategic bombing of ports, industries, and rail and road transportation systems. The spectacular success of the mining operations during the latter part of the war was undoubtedly magnified by the fact that enemy shipping had been so depleted by submarine and air attack that additional losses and blockade were very keenly felt.

Casualty data indicate, however, that minelaying has been the most economical in both men and material of all types of warfare against shipping. The indirect effect of mining on the enemy's military and economic supplies is necessarily omitted from such data, which fact serves to emphasize the conservative nature of this evaluation in com-



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parison with that of other forms of attack.

The most significant conclusion to be drawn from the analysis of the minelaying operations against Japan is that this type of warfare is an economical and effective means of attacking a maritime nation, with the added implication that both the offensive and defensive aspects of mine warfare should be given serious consideration in future planning for the security of the United States . . . .[3]

PART III — OFFENSIVE MINE LAYING — HISTORICAL SUMMARY

By the end of 1942 the perimeter of Japanese conquest formed roughly a circular arc of 3,000 miles centered at Tokyo. It extended from Kiska in the Aleutians, through the Marshall, Gilbert, and Solomon Islands in the Pacific, through Java, Sumatra and the Andaman Islands in the Indian Ocean, to Akyab in India. In acquiring this vast empire Japan assumed the new burden of supplying her numerous overseas troops and at the same time attempting to exploit economically the rich resources of her new territory. More than 7 million tons of Japanese shipping were employed in this essential effort. These ships were under constant danger, first from Allied submarines, then from aircraft, and finally from sea mines which menaced every important harbor and sea lane available to them.

1. Preparations

During 1942 the Navy had made extensive preparations for a coordinated strategic mine attack on the Japanese outer defense zone. Mines designed and produced by the Bureau of Ordnance during 1941 and 1942 were dispatched to Mine Depots established throughout the Pacific and in Australia, India, and China. These depots were staffed largely by personnel trained at the Mine Warfare School in Yorktown, Virginia, and at the Naval Ordnance Laboratory in Washington, D.C. Several future Mine Warfare Operations Officers were assigned duty in London to study at the Admiralty and report on the experience gained by the British in the war against Germany.

2. Objectives of Offensive Mining Campaign

The objectives of this mining campaign were to disorganize the enemy maritime supply system, deny him safe ports and shipping routes for the transport of essential war and economic materials, to sink and damage as many of his ships as he would expose to mine risk, and to impose upon him the military and economic burden incident to the establishment and maintenance of a mine defense.

3. Mine Laying Executed by Aircraft, Submarines, and Surface Craft

During the course of the campaign mines were laid by the United States Army and Allied Air Forces, as well as by United States naval aircraft, surface vessels, and submarines. All United States mines were prepared under the supervision of United States naval technical personnel. Mine Warfare officers directed, or collaborated in, the planning and execution of all operations. The cooperation between personnel of the different United States and foreign services in the logistic support and operational direction of mine warfare was exemplary in all war theaters and contributed much to the success of the campaign.

[3] "Since the B-29 mining campaign demonstrated for the first time that air power can carry the brunt of a strategic blockade of a powerful maritime nation, it is recommended that . . . (it) . . . be given careful consideration and evaluation in future military planning." Lt. Gen. N. F. Twining, USA, Commanding, 20th Air Force.

4. Two Campaigns — Outer and Inner Zones

The mining offensive commenced in October 1942, and continued until the end of the war. Essentially the campaign was divided into two major parts:

a. The first was a widespread persistent attack on enemy ports and shipping routes in the Outer Zone. From 1942 until the end of the war, nearly 13,000 offensive mines were laid in over 150 enemy harbors and shipping lanes throughout this Outer Zone. This was in effect an attritional campaign against enemy shipping on the fringes of Japan's new empire.

b. The other portion of the campaign was a large-scale aerial mining attack concentrated on the Japanese Inner Zone. B-29 aircraft executed these operations laying over 12,000 mines in every important enemy harbor in the Inner Zone. This attack extended from March 1945, until the end of the war. The unprecedented number of mines laid in so short a period resulted in a virtual blockade of shipping through the Shimonoseki Straits and in the Inland Sea of Japan . . . .

INNER ZONE CAMPAIGN

B-29s Concentrate Mining Attack on Empire Waters — Start of Blockade

By the end of March 1945, the continued offensive against the Outer Zone by direct submarine and air attack and by mine attrition, together with the forward advance of our forces to the Philippines and Iwo Jima and the initial assault against Okinawa, had forced the Japanese to withdraw most of their remaining 2,000,000 gross tons of shipping to the Inner Zone. Here, operating in the comparatively shallow and well-protected East China Sea, Yellow Sea, and the Sea of Japan, the remnants of the Japanese merchant fleet shuttled back and forth between the Asiatic continent and the home islands, relatively safe from attack by United States submarines or heavy bombers. Most of this shipping which was adequate at the time to supply Japan's needs within the Inner Zone, passed through the strategic Shimonoseki Straits to industrial ports located on the Inland Sea of Japan. In an attempt to blockade this water-borne commerce and thus sever the Japanese lifeline to the Asiatic continent, B-29s newly based in the Marianas now undertook an unprecedented saturation mining campaign directed at Japanese home waters to remove these waters from the list of areas safe for enemy ships. On the opening night of the mining effort, just prior to the landings on Okinawa, the Superforts of the Twenty-first Bomber Command carried nearly 1,000 magnetic and acoustic mines to the Shimonoseki Straits and the Inland Sea. Thus, at a most opportune moment the Japanese were denied the use of sea lanes on which they depended heavily, both to rush reinforcements to the Ryukyus and to bolster their homeland for the impending invasion.

This mining attack on the Inner Zone which began so spectacularly in late March continued until the end of the war. More than 12,000 mines were laid in every significant channel and harbor in Japan and Korea. The Shimonoseki Straits and all important industrial ports were almost completely blockaded. Hundreds of ships were delayed, sunk, or damaged and supplies vitally needed in industrial and populated sections were diverted to northern Honshu ports where much of it remained waiting to be hauled over an already overloaded transportation system to its useful destination.

First Phase (27 March - 2 May) — Okinawa Support

The mining campaign against the Empire was divided into 5 phases. The first phase was planned in support of the Okinawa operation. The Shimonoseki Straits, the Naval bases of Kure and Sasebo, and the military port of embarkation of Hiroshima were mined in an effort to endanger movements of Japanese naval units in those places. It was particularly desired to prevent the sortie of the Japanese Fleet through the Shimonoseki Straits from whence it could speed to the defense of Okinawa under cover of western Kyushu. In this the mining was successful: the only task force which did sortie, attempted to slip out of the Inland Sea via the Bungo Suido (east of Kyushu) where U.S. units lay in wait. It was at this time that the battleship YAMATO was intercepted and sunk.

Second Phase (3 May - 12 May) — Industrial Center Blockade

The second phase, termed the "Industrial Center Blockade," was begun on 3 May. The purpose of this attack was to destroy the sea-borne communication routes between the great industrial zones of Japan by maintaining the blockade of Shimonoseki Straits and by mining the ports of Tokyo, Nagoya, Kobe, Osaka, and the main shipping lanes of the Inland Sea. This phase marked the introduction of the "unsweepable" pressure mine, most potent undersea weapon developed during the war. A total of 1,422 mines of all types were used in this phase. Shipping at all ports began to fall rapidly and ship sinkings and damage immediately increased. Much of the shipping which formerly passed from Korea and Manchuria through the Shimonoseki Straits to industrial ports on the Inland Sea was now diverted to northwest Honshu ports or to Kyushu.

Third Phase (13 May - 6 June) — Northwest Honshu—Kyushu Blockade

The third phase began on 13 May. It was the purpose of this attack to blockade the bulk of enemy shipping moving from the Asiatic mainland to Japan by continuing the blockade of the Shimonoseki Straits and by mining all the major harbors of northwest Honshu and Kyushu. A total of 1,313 pressure, magnetic, and acoustic mines were dropped. This phase saw the introduction of another "unsweepable" mine, the low-frequency acoustic, which was used for the first time to confound the Japanese in their feverish attempts to develop mine countermeasures. Shipping continued to decrease in Shimonoseki Straits and the industrial ports. There was a corresponding slight rise in shipping in the northwest Honshu and Kyushu ports, but the newly laid mines resulted in many casualties among ships which had been sent to these ports as the lesser of two evils.

Fourth Phase (7 June - 8 July) — Intensified Northwest Honshu-Kyushu Blockade

The fourth phase began on 7 June and consisted of a similar but greatly intensified attack. An effort was made to complete the blockade of northwest Honshu and Kyushu by mining the secondary and tertiary harbors in these areas, and also to maintain blockade of Shimonoseki Straits and the primary ports of northwest Honshu and Kyushu. The important port system of Kobe-Osaka was also mined repeatedly during the fourth phase. A total of 3,542 mines of all types were laid in this expansion of activity. During this time ship losses accumulated rapidly in all mined areas; shipping began to drop off in the northwest Honshu and Kyushu ports, while in the Shimonoseki

Straits and in the industrial ports the situation approached a complete blockade.

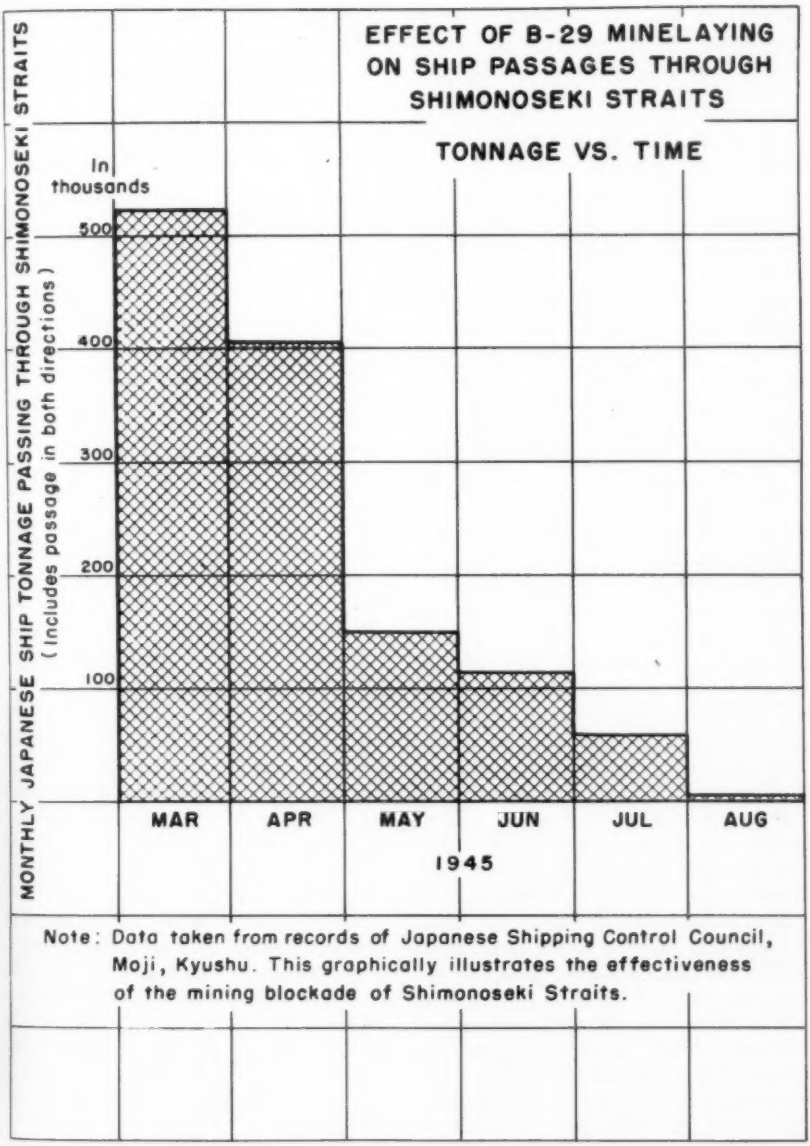
In conjunction with this fourth phase, Navy PB4Y-2 (Privateer) aircraft of Fleet Air Wing One, based on Okinawa, conducted an attrition mining attack against shipping operating from the Yellow Sea around the southern coast of Korea. Between 10 June and 1 July, these planes planted 186 mines in the archipelago along the south coast of Korea, forcing shipping to abandon routes around the many islands in the area and to move out to clear water where it was vulnerable to direct attack. This mining finally eliminated altogether the movement of ships of over 1,000 tons.

Fifth Phase (9 July - 15 August) — Total Blockade

The fifth phase carried the blockade to remaining enemy shipping at every possible point by mining all the ports of Korea while maintaining the blockade of Shimonoseki Straits and the entire northwest Honshu-Hyushu area. A total of 3,746 mines was dropped in target areas. They resulted in continued shipping losses and a falling off of traffic in all ports. The closing days of the war found Japan ringed with ports polluted with aerial mines. Shipping through the Shimonoseki Straits and in important industrial ports had been reduced to a trickle. The Japanese were not able to clear any of their shipping lanes efficiently, but pre-

Credit: U. S. Air Force

A view of aerial mines being prepared for loading on B-29's based in Chengtu, China, during the month of January, 1945. The Ordnance men shown were part of the 468th Bomb Group. The mines were released from the bomb bays and floated into the seas by means of a small parachute.



Note: Data taken from records of Japanese Shipping Control Council, Moji, Kyushu. This graphically illustrates the effectiveness of the mining blockade of Shimonoseki Straits.

ferred to take abnormally high loses rather than stop completely. Their ships used the diversionary ports on northwest Honshu and Kyushu only as a desperate measure to get supplies to the mainland. However, even this accomplished little as the limited inland transportation facilities prevented final delivery of the necessary food and materials to the heavily populated industrial regions on the Inland Sea. This mining also prevented the use of all but 3 of the 22 principal merchant marine shipyards, and repair work on damaged shipping far exceeded the limited capacity of those few unmined yards. As a result, any substantial damage to merchant vessels was the equivalent of sinking, since its use was denied the Japanese for the duration of the war.

These accumulated results of the mining campaign left Japan little hope of continuing the war for long. Resultant shortage of coal, oil, salt, and food contributed so completely to paralyzing industry that shortly before surrender leading industrialists indirectly informed the militarists that industry could not continue. They estimated further that 7,000,000 Japanese would have starved to death if the war had continued another year.

The entire B-29 attack on the Japanese Inner Zone had used 12,135 mines. It required only 1,529 sorties representing but 5.7 percent of the Twenty-first Bomber Command's total effort. Admiral Nimitz in his commendation of the execution of the campaign, has described the results as being phenomenal. Prince Konoye has estimated that in the final months of the war the mining attack was equally as effective as the bombing of Japanese industry which occupied the other 94.3 percent of the B-29 effort. A complete evaluation of all intelligence available on the results of the minelaying leads to the conclusion that the over-all contribution to the war effort was most worth-while, and that it was accomplished with a minimum expenditure of effort.[4]

PART IV — WAR LESSONS AND COMMENTS

I. PLANNING

1. Need for Adequate Preparation

One of the biggest handicaps in the mining campaign against Japan was the lack of adequate preparation in peacetime. Many aspects of modern mine warfare were new. The possibility of using influence mines against enemy water-borne commerce or naval forces had not been fully investigated, nor had the use of aircraft to drop such mines been seriously considered. The development of mines and other underwater weapons had suffered greatly in the prewar period because at that time there was no well-balanced program or policy to guide their research and development. Much of this could be traced to lack of funds for technical research; some of it, however, was attributed to the fact that little thought was given to the operational aspects and potentialities of offensive mine warfare. The latter status resulted partly from the absence of a type organization in the Navy Department responsible for planning and general supervision of mine warfare matters ashore. At sea, commands could not easily carry out realistic mining exercises, so few recommendations based on experience came from that source. As a result, few operational demands were made on technical organizations and few new mines were developed. In the early part of the war in the Pacific, confi-

[4] "The planning, operational, and technical execution of 20th Air Force aircraft mining on a scale never before attained, has accomplished phenomenal results and is a credit to all concerned." Fleet Adm. C. W. Nimitz, USN, Commander in Chief, U.S. Pacific Fleet.

dence in mining suffered from the lack of suitable weapons. As better mines became available, the results of mining improved and its popularity increased.

This early lack of preparation for offensive mining is mentioned only because it serves to demonstrate the need of avoiding a repetition of this error in the postwar period . . . .

2. Need of Early Decision on Mining Program

In order that the mine requirement of the operating forces may be fulfilled with a reasonable degree of success it is essentiatl that, prior to or early in a war, a decision be made regarding the desirability of a major mining campaign; only then can plans be prepared which will provide for the necessary logistics. In the last few months of the war with Japan the Twenty-first Bomber Command was able and willing to devote a still larger portion of its effort to mine laying, but sufficient mine stocks were not available. The basic reason for this lack of stocks was that the decision to carry out such a large-scale attack was not made until shortly before the actual mining attack began. Consequently, in view of the many other definite logistic commitments in the Pacific, there was an early and reasonable reluctance to give mines the necessary priority in both production and shipping . . . .

II. OPERATIONS

1. General

a. Almost Too Little Too Late

Despite the success of the mining campaign, the attack was very nearly "too little—too late." In nearly every area offensive mining would have produced greater results if it could have begun at an earlier date and on a larger scale. As previously stated, the delay was due to the lack of early development and early basic thought on the offensive possibilities of mine warfare. This type of warfare was new, and had to undergo a period of proving itself before it was accepted. It is fair to state, however, that after the early successes of offensive mining, theater commanders used this weapon as soon as bases and suitable mines became available.

The development, production, and supply of mines themselves was pushed with particular vigor during the latter months of the war and the logistics in this regard were outstanding considering the handicap at the start. As a result, the mining campaign progressed with a tempo which paralleled the overall prosecution of the war against Japan. The nature of mining attack is such, however, that it could have preceded other offensive action to a greater extent than it did, and in this way would have made a still greater contribution to the war . . . .

"The peril of the hour is obvious. There is something more important than any ultimate weapon, that is, the ultimate position—the position of total control over the earth that lies somewhere out in space. . . .

"Whoever gains that ultimate position gains total control over the earth for the purposes of tyranny or the service of freedom."—Senator Lyndon B. Johnson before a Senate Party Caucus, January 7, 1958.

ACROSS THE NORTH POLE TO AMERICA—1937

By COLONEL MIKHAIL GROMOV

For almost a decade after Hiroshima, many uninformed Americans were very skeptical about the oft-stated assumption of Air Force planners that the Soviet Union could strike the United States by flying directly across the arctic icecap. To document the historic interest of the Soviet Air Force in intercontinental air operations, the editors of THE AIR POWER HISTORIAN present below the propaganda version of a nonstop transpolar flight from Moscow to San Jacinto, California, in July 1937. Carrying the by-line of the first pilot, Mikhail Gromov, a Colonel in the Red Army, the article below was originally published in English by the Soviet Foreign Languages Publishing House in Moscow in 1939.

In the interest of promoting "friendlier" relations with the United States while Hitler rocked the diplomatic boat in European waters, the Soviet Union planned a campaign to dispatch a series of long-distance nonstop flights from Russia to the United States. On June 26, 1937, the first of these Soviet flights landed at Vancouver, Washington, after a nonstop flight of 5,288 miles. The article below recounts the second of these flights which departed Moscow on July 12th, landing 62 hours and 6,262 miles later at San Jacinto, California. No record exists of the third project flight in this series.

Gromov became a Hero of the Soviet Union, member of the Order of Lenin, and a member of the Supreme Soviet of the USSR. His version of the flight below may be of double interest because this English language version well demonstrates to what lengths the Soviets were willing to exploit marginal equipment in persuasive fashion to impress a world disturbed by Adolf Hitler. Soviet air technology has proceeded a long way from the 950 h.p. single engine aircraft with no brakes used in 1937, but the marked similarity in Soviet propagandistic techniques of 1937 *and those of* 1958 *should be readily apparent. Basic purpose would seem to be the same with only features changing.*

The idea of flying to America across the North Pole occurred to me long ago. It attracted the interest of a number of Soviet airmen. Sigismund Levanevsky, Hero of the Soviet Union, was the first to moot the idea of a transpolar air route between the USSR and the USA publicly in the press. After this Soviet fliers began to study the problem seriously.

The shortest distance between the Soviet Union and America is across the top of the earth. The suggestion of establishing such a service is a striking instance of the endeavor of aviation to be independent of land routes. It is said that an airplane, like a bird, can fly straight to its destination, undeterred by mountains, forests and seas. But in practice, as we know, this is far from the case.

There are quite a number of extensive areas of the globe over which no plane has ever yet flown. Until recently it was believed (especially abroad) that flying in the Arctic was impossible. However, the development of polar aviation has shown that to Soviet planes and Soviet airmen the stern North is no insuperable barrier. The *Chelyuskin* epic, the numerous flights undertaken in the Arctic for the purpose of reconnoitering the ice and tracing the movement of fur animals, and finally, the brilliant operation of 1937, when four heavy planes were

landed at the North Pole itself, all testify to the successful conquest of a region of the globe which perhaps offers more difficulty to flying than any other.

The flight of the squadron of planes to the very Pole, their splendid landing on a drifting icefloe, and their return to the mainland without damage or untoward incident was a great event in flying. It changed and expanded our ideas of the potentialities of aviation.

Long-distance nonstop flying has interested me for a long time. The flight to America across the North Pole was the fifth of my long-distance flights. Fourteen years ago a group of Soviet airmen, including myself, flew from Moscow to Peking. The plane I used was an R-1, the first airplane designed and produced in the Soviet Union. The flight took us thirty-three days. On arriving in Peking we learned that the French airman Arrochard had flown an equal distance in three days. A year later, I started out on another big flight. I made the circuit of Europe on a Soviet all-metal plane in three days. Arrochard's feat proved to be within the scope of Soviet pilots. Three years later I made my third long flight, again the circuit of Europe, this time on a tri-engined plane, "Wings of the Soviets."

I made my fourth long-distance flight on an RD plane in 1934, beating the world distance record in a closed circuit. My comrades on this flight were Spirin, navigator, and Filin, engineer. It was our good fortune to demonstrate that Soviet planes and Soviet engines were among the best in the world. We remained in the air for 75 hours and covered a distance of 7,707 miles. Our record was not officially registered because the USSR was not yet affiliated to the International Aeronautical Federation.

In 1935 this same crew applied for permission to make a nonstop flight from Moscow to America across the North Pole. We were unable at that time to put our plan into execution, but I was determined to continue my efforts in the sphere of long-distance flying. In this I was interrupted by protracted illness and my work on testing new airplanes, but I did not give up hope. My ambitions brought me into close contact with Yumashev, a splendid airman and international record holder, and Danilin, who in my opinion is the best navigator in the Soviet Union. We planned several long-distance flights, one of which was particularly interesting; from Moscow to Brazil, across the Black Sea, the Mediterranean, the Sahara Desert and the Atlantic Ocean. Careful preparations were made for this flight, but for a number of reasons it had to be deferred.

Yumashev worked out the details of several other interesting flights, one of them from Moscow to Australia. I was interested in initiating an air route from the USSR to America across the Atlantic Ocean; I also worked out in fairly great detail the route for a record distance flight from Moscow to Mexico, via New York.

But, of course, what interested us most was the plan for the flight from Moscow to America across the North Pole, which had been temporarily postponed, but to which we returned again and again.

We worked on the details of this flight for two years. This may seem a long time. But the result was that many problems which had formerly seemed insoluble now became perfectly clear to us. We had a complete picture of the details of the proposed flight. This gave us great satisfaction. We proposed to use a plane which I had been testing for nearly two years, RD No. 25-1.

It was a monoplane of the classical type with underslung wings, and at that time was undoubtedly the most suitable craft in the world for long-distance flying. RD No. 25-1 was the embodiment of the most-up-to-date innovations in aircraft construction. A machine of this type had been displayed in 1936 at the World Aviation Exhibition in Paris and had profoundly impressed the connoisseurs.

We did everything we could to reduce the weight of the machine. We removed the rubber chambers which enabled the plane to keep afloat on water, adapted the engine-covers to serve as sleeping bags, decided to do without brandy and fire-arms and reduced the food supply from a 2 months' to a 1½ months' ration. We thus managed to lighten the load by nearly 400 lbs. We accordingly increased the supply of fuel, oxygen and water for the engine by this amount.

Having increased the potential range of the plane by lightening its weight and increasing the supply of fuel, we turned our attention to the selection of the propeller. This absorbed a great deal of time and energy. We made a large number of test flights to ascertain the expenditure of fuel and the ways of economizing it.

Two wireless apparatuses were installed.

The original range of the RD No. 25-1 was 4,350 miles. But when a geared engine was installed, the range was increased to 6,200 miles. Experiments showed that the corrugated surface should be replaced by a smooth surface, and this increased the range by roughly another 1,250 miles. Finally, after covering the anterior edge of the wing with a polished surface, we were able to fly 7,700 miles without a stop. The installation of metal propellers still further increased the range.

We made a thorough and careful study of our craft. It had to be ascertained what height and speed should be maintained as the flying weight of the plane changed with expenditure of fuel. In the end, enough material was collected to enable us to know exactly in advance what distance could be flown in calm weather. But inasmuch as calm weather could not be expected along the whole of the long flight we were contemplating, we had to discover the laws which tell us how to fly to achieve the maximum distance.

In the end, we had at our disposal extensive charts showing what speed and elevation to maintain under various conditions. This clarity on all questions proved to be one of the most important factors determining the success of our nonstop flight. We had a good knowledge of the flying qualities of our plane. The engine was not only economical but absolutely reliable, and in this respect was unequalled.

What caused us most uneasiness was the meteorological aspect of the problem. The comparatively small margin of stability of the plane in the early hours of the flight (owing to excessive load) demanded calm weather at least during this period. After that the only serious danger to be feared was the formation of ice on the propeller and wings. For two years we had been studying everything published at home and abroad on the reasons for this phenomenon so as to find a means of combating it. We finally arrived at the conclusion that the lower the temperature, the less the chances of ice forming, and that in clouds at a high altitude this danger was entirely precluded. At a temperature below -20°C. the danger of ice forming was very slight. It was therefore necessary, in the event of the danger of ice forming, that our plane should be able to reach an altitude where the temperature was below -20°C.

Thus some of the most difficult problems of the flight were settled before the actual take-off.

I had known Yumashev and Danilin, my comrades in the flight, for a fairly long time. They had performed no "miracles," but they were capable of any exploit. I had had repeated opportunities of convincing myself of this. There was every reason to think that the composition of the crew was such as to ensure a successful issue to the flight.

Before the start an event occurred which rather altered the character of our task. Chkalov, Baidukov and Belyakov made their splendid flight to America. This altered the situation somewhat. It was no longer enough to fly to any point in the USA. It must now be our purpose not only to confirm the possibility of a transpolar air route, but to attain the maximum distance of flight.

Such being the case, weather conditions assumed cardinal importance. In this respect the year 1937 was generally unfavorable for flying in the Arctic. On the eve of the start we were told by prominent meteorologists that we must expect head winds and unfavorable weather. However, time did not permit us to wait for better weather. Moreover, we calculated that even with such unfavorable weather conditions we could beat the world distance record. All that was needed was to adhere strictly to the altitude charts, to maintain a definite regime for the engine, and not to deviate from our course under any circumstances. We must not turn aside to avoid cyclones or other meteorological obstacles, for that would considerably reduce our range. We would have to fly in a straight line. Of course we knew that some deviation from the ideal schedule, and consequent loss of distance, were inevitable; but we decided to reduce them to a minimum.

I must have been born under a lucky star. During my twenty years as a pilot I have had to make several big flights. And they have all ended successfully.

Every time I was assigned a big flight I experienced a sense of real happiness. Just before the take-off, however, I would be greatly agitated; but no sooner was I in the air than I recovered complete composure. Usually I was so agitated before a flight as to lose all appetite; I could take nothing but hot tea. But calm having returned after being in the air for ten or fifteen minutes, I would develop a wolfish appetite.

So it was this time: first a feeling of pleasure, then profound agitation, and then that wonderful composure and confidence.

We took off on July 12, 1937. The start was an unusually difficult one.

It may be said with certainty that if the plane had carried another 200 lbs. the runway would have been too short for the take-off. The end of the runway was startlingly near, and I had to lift the plane steeply to keep the wheels from touching the rough ground beyond its edge. We were hardly off the ground when we began to retract the landing gear. I repeat, never have I had to make so difficult a take-off.

We had barely reached an altitude of 1,100 feet when the earth was veiled from our sight by mist. We mounted to 2,620 feet, and then flew in a corridor between two layers of clouds. Only two and a half hours later, at a height of 3,610 feet, did we emerge clear of them. On the right, the sun broke through a bank of feathery clouds.

After five hours of flight, Yumashev took my place at the controls, and I addressed myself to some refreshment. We did not see land again until we reached Kolguyev Island. On the basis

of the speed and time of flight, Danilin calculated that we were approaching the island. Yumashev brought the plane down below the clouds and we saw Kolguyev Island beneath us. We descended to about 650 feet. The plane was buffeted violently. At this height we passed over the spot where the referee of the Central Aeronautical Club of the USSR was to register our transit. Had it not been for this, of course, we would not have descended so low and subjected our craft to the risk of being smashed by the heavy jolting. Yumashev lifted the plane to its former altitude. I replaced him at the controls.

Down below, the blue waters of the Barents Sea were visible. We were heading for Novaya Zemlya. We first spied it at a distance of 60 miles. As we approached within 30 miles of it a picture of unusual beauty and mystery opened before us. From afar, Novaya Zemlya looked like the sunlit shore of a southern sea, with long sandy banks of vivid hue, reminiscent of sunshine and warmth.

A layer of strato-cumulus cloud approached from the left and concealed the sea. Over Novaya Zemlyn we twice descended to a level of 1,000-1,300 feet to have our flight registered. We then slightly altered our course to hit the 120th meridian at the spot where it led straight through Rudolph Island to the North Pole and then on to California. Here we again rose above the clouds.

A white veil appeared on the horizon and covered the sky. This was an approaching cyclone. Several hours passed. Yumashev informed me that he had detected some dark spots below which must be Franz Josef Land. Soon we spotted the snowy summits of the archipelago. We could feel the breath of an approaching cyclone. Strata of black cloud and humpy cumuli again floated by. The scene was again overcast.

The only way we could avoid cyclones was to rise above them. We firmly stuck to our determination not to depart from our schedule unless absolutely necessary, and not to diverge from our course under any circumstances. Only forward, and only along a straight line, was our motto.

We had already reached an altitude of over 13,000 feet; the temperature had fallen to -16°C. Clouds barred our way. Nothing was to be seen. We kept our course by the radio signals from Rudolph Island, which now lay behind us. We flooded the propeller with liquid to prevent ice forming.

We continued to ascend. I noticed that the windows of the cockpit were covered with a crust of ice. Only at a height of 14,700 feet, where the temperature was -21°C. did they become transparent again. We nosed our way through high cumulus clouds. Then again flew blindly.

It suddenly grew lighter and the plane emerged from the clouds. Below us lay a white sea of feathery cloud. The sun shone brightly. We breathed freely.

Fighting our way through two cyclones, we approached the North Pole. We had already been in the air twenty-four hours. During this time all we had seen of the earth was the stretch between Shchelkovo and Zagorsk—two towns lying close to Moscow—a patch of Kolguyev Island, the peaks of Novaya Zemlya and about 125 miles of sea. All the rest of our route had been covered by clouds. We had flown either above them or through them.

As we passed in the vicinity of Papanin's camp on the drifting icefloe, we could not refrain from radioing a message of greeting to the explorers. This was on July 13 at 2:07 A.M. Here is the message:

"Greetings to the conquerors of the Arctic, Papanin, Krenkel, Shirshov and Fyodorov, from the crew of the RD No. 25-1, Gromov, Danilin, Yumashev."

An hour later, to be exact, at 3:14 A.M., we passed over the North Pole. We were then at an altitude of 8,850 feet and were making a speed of 100 m.p.h. The temperature of the air was -8°C. The crew were in excellent spirits.

Yumashev was at the controls. I went to lie down. I slept soundly for an hour and awoke with a keen appetite. I had hardly taken a bite when I observed a dark bank ahead of us. Here was a cyclone waiting for us on this side of the Pole. I took my place at the second controls to help Yumashev; but the cyclone proved to be feebler than its predecessors, and in half an hour the fight was over.

The weather cleared and we flew beneath a bright polar sun. From time to time, through breaks in the clouds, we saw the ice beneath us, traversed by fissures. The scene was grand but monotonous. The icy wilderness seemed endless.

After a while we perceived some dark patches against the clouds on the horizon. The nearer we approached, the more distinct they became. Suddenly we saw they were cliffs. Land! This was Patrick Island.

The breaks in the clouds became more frequent. The sea between the islands and the mainland was covered by white humpy ice, spattered with emerald and blue patches. The sun became dimmed. Clouds passed over us from time to time. All this lent the scene a mysterious and oppressive, yet majestic air.

The Canadian tundra appeared. The sky cleared. Unknown land stretched beneath us: numberless lakes of varying size and shape, bogs, rivers, and scrub, gradually passing into forest. This monotonous landscape stretched as far as the Rocky Mountains, which well deserve their name.

While over Canadian territory we heard for the last time the signals of the Moscow radio station which had been maintaining contact with our plane. We were at that moment at a distance of 3,725 miles from the capital of the Soviet Union.

The Rockies were covered with clouds. Keeping our course along the 120th meridian, we gradually ascended and successfully negotiated the mountain peaks. Beyond the Rockies we flew hemmed in by clouds. Ice suddenly began to form on the plane. Both the speed indicators failed. We descended, and only at a height of 9,800 feet did we emerge from the danger zone.

Shifting our course 10° or 15° to the right, we reached the shores of the Pacific in the vicinity of Seattle. An hour later the clouds above the hills evaporated, but the shore and sky were still veiled. Ahead of us, a splendid blue sky could be seen. This gave us hope that we would have fine weather during the night.

The first real night of the flight began. This was between Seattle and San Francisco. We espied the shore through breaks in the clouds. Below us gleamed the beacons of flying fields, and the lights of cities and villages. We flew beneath a clear sky. To the right lay the Pacific, veiled by clouds; down below lay the land. From our height of about ten thousand feet we could distinguish a chain of lighthouses. A head wind blew; it seemed as if we would never reach San Francisco.

We felt the effects of fatigue. The gas indicator was very encouraging. As we approached San Francisco, we saw that we could fly farther, and enquired of other flying fields whether

they could receive us. We were informed that the flying fields in Los Angeles and San Diego would be covered by mist in the morning. We were referred to other flying fields, which were not easy to discover on the map.

However, our gas supply would permit several more hours of flying, so we radioed: "Have passed San Francisco; are continuing our flight." Yumashev and Danilin asked whether we ought not to inform the Soviet Government that we had beaten the world distance record; but I had firmly made up my mind not to give way to jubilation, and not to send any messages until our flight was over and our plane safely landed.

It was late in the night when we reached the midway point between San Francisco and Los Angeles. The line of beacons swerved to the left. We kept straight on. Dawn was already breaking when we crossed the Cordilleras, which were not very high at this point, and flew over San Jacinto. We left Los Angeles behind us to the right, and headed for San Diego.

We were out of luck. The Mexican border was too near to permit us continuing our flight to the south and thus increasing our distance record.

The flying fields in the southernmost part of California and the whole strip, thirty miles wide, between coast and mountains were covered by morning mist. We were therefore obliged to turn back. We circled around for half an hour in search of a suitable landing place.

When I decided to land there was still enough fuel in the tanks for another six hours of flying. Anyhow, we had already beaten the world distance record some 200 miles north of San Francisco. After a careful scrutiny of the flying ground at March Field, we searched around for a somewhat larger landing place, for our now lightened plane demanded a good approach and would require a rather lengthy running space before coming to a standstill. We selected the only large, although rather uneven field, in this semi-wilderness, and 62 hours and 17 minutes after the take-off in Moscow we made a successful landing some three miles from San Jacinto, California.

Reckoned in a straight line, we had flown 6,302 miles. Our plane was severely shaken and jolted on landing because of the hard, rough ground, but neither it nor the equipment suffered the slightest damage.

Danilin, our navigator, was the first to alight. There was not a soul to be seen, but a minute later he noticed an old and dilapidated automobile bounding over the hummocks towards us. A young man jumped out and addressed Danilin in English. We had provided for such an emergency in Moscow and had had the following note written for us in English: "We are Soviet airmen flying to America from Moscow across the North Pole. Please inform the Soviet Ambassador in Washington, the local authorities, and the nearest flying field that we have safely landed."

The young man leaped into his car and dashed to the telegraph office. A moment later the field was invaded by people and automobiles. Learning that we had flown from Moscow, the inhabitants of San Jacinto at once began to assail us with requests for our autographs. A military airplane arrived from March Field. The major placed a guard on our plane and bore its crew off in an automobile to March Field. There referees were appointed to examine our barographs and gas tanks and to determine the coordinates of our landing place.

After this we were no longer our

own masters. We were visited by not less than a hundred press reporters and photographers daily. After our long journey we were allowed only three hours to rest in, although our obliging hosts of the American Air Force at March Field did everything in their power to make us comfortable. They even forbade all flying in the neighborhood during the three hours we were asleep so as not to disturb our rest.

Telegrams came pouring in. I was already awake when congratulations arrived from Comrade Stalin and from the leaders of the Communist Party of the Soviet Union and of the Soviet Government. What could we reply to such a mark of attention? My comrades and I sent a return message to the Kremlin in Moscow containing the assurance that we would be happy to perform any other commission for the benefit of our beloved country.

* * *

If we were asked what part of our journey from the USSR to America seemed to us most dangerous, we would say that it was the route from San Diego to New York. . . . We were deafened by the shouts of welcome, rendered hoarse by the speeches we delivered at banquets, and blinded by the endless magnesium flashes of the ubiquitous reporters and photographers.

The Americans are great admirers of technical progress. I think that the cordial reception we were accorded by the authorities and the enthusiastic welcome we were given everywhere by the American people must be chiefly regarded as a tribute to the technical achievements of Soviet aviation. Our flight was not undertaken for sensational purposes; our aim was a technical one—to establish the shortest air route between the USSR and the USA. There was a fairly large amount of fuel left in our tanks when we landed, and had we desired we could have continued our flight still further.

We flatter ourselves that our flight has helped to strengthen the ties of friendship between the two countries. It has also performed no little service in respect to exchange of experience between the aircraft industries of the two countries. We have still a lot to learn from the Americans in regard to flying and the making of flying machines.

It is with a feeling of warm regard and gratitude that I recall my meetings with Upton Sinclair, with Ernie Smith, the famous pilot who was the first to make a long-distance flight from San Francisco to Honolulu, and with many other Americans.

We were very cordially received by Mr. Roosevelt, President of the United States.

Mr. Roosevelt impressed us by his vigor, energy and vitality, and by his simplicity of manner. Our meeting with him will always remain one of the most significant recollections of our American visit.

* * *

To sum up, it may be said that the great Land of the Soviets has made considered progress in the sphere of aeronautics. Its designers and industry are producing excellent planes and motors. Splendid airmen are being turned out by its flying schools and by the Red Army. The USSR is a flying country. There can be no doubt that in the near future new and striking records will be established in height, speed and distance. I myself have no doubt that the Soviet Union will not lag behind other countries in this respect; if anything, it will outstrip them. It has all the potentialities for it.

A REPORT FOR CONSIDERATION OF THE REORGANIZATION OF THE ARMED FORCES—1946

By MAJ. GEN. ORVIL A. ANDERSON, USAF (Ret)

There has existed a conflict, in measure, to give appropriate recognition to the airplane as a weapon system since its introduction to the conventional family of military arms in 1908,—following by five years the first successful airplane flight. Inherent in that conflict has been a continuing struggle stimulated by hindsight, to adjust organization and employment of this unique weapon system to the ever-growing demands of change. History clearly discloses that the series of reorganizations and modifications of roles and missions that characterized the growth of the air arm always lagged behind the demands of realism in giving validity to the potential of this new, and therefore unproven, category of warfare.

Today we are again in process of reorganization of our military structure for the avowed purpose of giving it sounder military posture. To many, some of the arguments being propounded in support of this realignment are new and novel; to others they represent the basic attitudes and values of the past,—with new embellishments.

The contribution of air power in World War II, transcending the roles and missions to which strategy had assigned it, motivated some strategic thinkers to reappraise the significance of air power in modern war. The rapid technological advance in weapons enhanced this need. One result of this attitude and thinking was the creation of the United States Strategic Bombing Survey, with an overriding directive, to evaluate the contribution of strategic bombing to the war as it was fought.

Following the termination of that survey and the submission of its conclusions, Maj. Gen. Orvil A. Anderson, the Senior Military Advisor, prepared a report for the Secretary of War on 11 July 1946, which endeavored to translate the conclusions of that survey into significant military values. This summary report was focused on an exposed need for realignment of force and strategic purpose in the three primary categories of military conflict,—air, ground, and water. The observations submitted in this report appear equally relevant to the reorganizational issues we are facing today.

SUBJECT: Summary Report, United States Strategic Bombing Survey
To: The Secretary of War
Thru: The Commanding General, Army Air Forces

1. The Final Summary Report of the United States Strategic Bombing Survey, covering the war against Japan, has been forwarded to your office. As Senior Military Advisor to the Survey,

it has been my opportunity and responsibility to examine with great care the information gathered by the Survey. Throughout the preparation of the Report, I have advised the Chairman's Office according to my interpretation of the facts assembled. At this time I feel it is incumbent upon me to submit my appraisal of the Chairman's final opinion as presented in the Summary Report. In arriving at the decision to submit this memorandum, I have given careful consideration to the facts assembled by the Survey as they bear on the terms of the directive issued by the late President Roosevelt and reaffirmed by President Truman.

2. During the Pacific phase of its investigation, the Survey covered a wide range of territory and assembled a vast amount of material relating to the military, economic, and sociological effects of our combined assault against Japan. The Survey is to be commended for the broad scope of its coverage. The many reports dealing with various aspects of the war which will emerge from this study will be of value to their separate fields of interest. Termination of its activity finds the Survey well supplied with source material with which to establish a basis for evaluating air power as an instrument of military strategy and for predicting its significance to the future development of our armed forces.

3. For many years prior to World War II, this Nation had been struggling to determine the probable role of air power in warfare. Our search for the answer to the problem had been made difficult by the independent and distinct stature of the two departments of national defense which provided the background for the struggle. The three major questions arising from the problem may be stated briefly as follows:

a. Does air power, properly developed and supported, constitute a primary striking force of such characteristics that it can achieve victory over our enemies by destroying their sustaining resources and will to wage war?

b. What strategic conceptions must be adopted in order to exploit fully the military potentialities of air power?

c. If air power does constitute a decisive force, what is the proper military organization to exploit its potentialities?

4. In an effort to arrive at an unbiased and expert opinion on these questions, many boards have been appointed in past years to study the problem. The two major boards in the past which had essentially the same ultimate responsibility as the United States Strategic Bombing Survey were the Baker and the Morrow Boards. As distinguished as were the Chairmen of these two boards, in neither case were they able to come forward with a solution which evaluated realistically the military potentiality of air power. However, all boards prior to the formation of the United States Strategic Bombing Survey had been asked to formulate an opinion based on limited experience, supported by prophecy, regarding the potentiality of air power and its future significance as an instrument of military strategy. The United States Strategic Bombing Survey had the distinct advantage of being the first agency able to rely on a reasonably extensive demonstration of air power for formulation of its final opinions.

5. The directive issued to the United States Strategic Bombing Survey charged this body with the responsibility for conducting an "impartial and expert study of the effects of our aerial effort in the war against Japan." The Survey's task, thus, was primarily to determine the effects of air action. The Report has reached somewhat beyond

this objective and has expressed considered opinions concerning future military strategy, organization, and policy. In so doing, the Survey is to be commended for its sense of responsibility and for its efforts to project its findings into the future. I am, therefore, gratified to report that—while the Survey's effort to project its findings into the future is only partially developed—the findings of the Survey and the factual data it gathered will provide a definite basis for a solution of our current strategic and organizational problems. It now becomes the problem of the United States Government to translate these findings into realities in revitalizing and reorienting our military structure.

6. Although the Survey Report has provided fundamentally sound answers to the questions under consideration, I feel that the Report has not given the proper degree of emphasis to these answers. As a broad evaluation of the Report, I consider it an instrument which perceives the truth but has not pointedly developed the fundamental issues as a working thesis. For this reason it lacks the focus, strength, and impact required to make it a compelling instrument of constructive military reform. In its present form it may invite controversy through divergent interpretations of the facts as presented.

7. For the purpose of bringing focus to bear on the major issues and to emphasize the most important findings of the Survey, the following paragraphs are quoted from the Report to point out wherein the Survey has provided the answers to the current vital issues concerning the significance of air power to future military policy.

a. Does air power, properly developed and supported, constitute a primary striking force of such characteristics that it can achieve victory over our enemies by destroying their sustaining resources and will to wage war?

(1) In its final conclusion, paragraph 5, page 28, under "Signposts," the Survey provides an answer to the above question:

"The experience of the Pacific War supports the findings of the Survey in Europe that heavy, sustained and accurate attack against carefully selected targets is required to produce decisive results when attacking an enemy's sustaining resources. It further supports the findings in Germany that no nation can long survive the free exploitation of air weapons over its homeland. For the future it is important fully to grasp the fact that enemy planes enjoying control of the sky over one's head can be as disastrous to one's country as its occupation by physical invasion."

(2) The following statements of the Survey give strength to its stand on this issue:

Page 29: "We underestimated the ability of our air attack on Japan's home islands, coupled as it was with blockade and previous military defeats, to achieve unconditional surrender without invasion. By July 1945 the weight of our air attack had as yet reached only a fraction of its planned proportion, Japan's industrial potential had been fatally reduced, her civilian population had lost its confidence in victory and was approaching the limit of its endurance, and her leaders, convinced of the inevitability of defeat, were preparing to accept surrender. The only remaining problem was the timing and terms of that surrender."

Page 29: "Our military and economic strength, however, made it possible to plan and execute a dual line of advance across the Pacific and to mount an air attack of suf-

ficient weight to induce unconditional surrender concurrently with the preparation of a full-scale invasion."

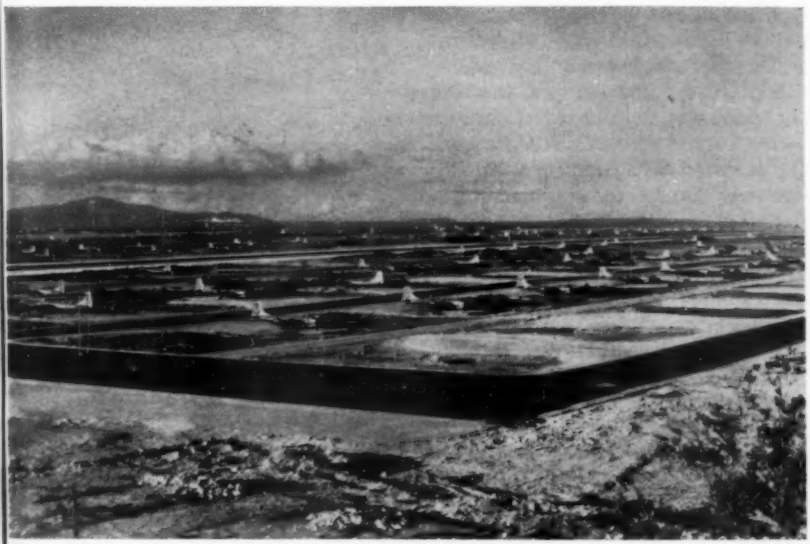
Page 26: "Based on a detailed investigation of all the facts, and supported by the testimony of the surviving Japanese leaders involved, it is the Survey's opinion that certainly prior to 31 December 1945, and in all probability prior to 1 November 1945, Japan would have surrendered even if the atomic bombs had not been dropped, even if Russia had not entered the war, and even if no invasion had been planned or contemplated."

(3) The above conclusions are made without consideration of atomic power. As an indication of the increased capability of air power when employing atomic explosion, the following Survey conclusions are pointed out:

Page 29: "The atomic bomb, in its present state of development, raises the destructive power of a single bomber by a factor of somewhere between 50 and 250 times, depending upon the nature and size of the target. The capacity to destroy, given control of the air and an adequate supply of atomic bombs, is beyond question."

Page 30: "Given an adequate supply of atomic bombs, the B-29's based in the Marianas had sufficient strength to have effectively destroyed in a single day every Japanese city with a population in excess of 30,000 people."

(4) In considering the above conclusions, it is significant to observe that what was left of Japan's economy, at the time of her surrender in August 1945, was incapable of sustaining even



Credit: U. S. Air Force

North Field on Tinian, home of the 313th Bombardment Wing, shows the concentration of air power applied against the vital structures of Japan in the closing phase of the Pacific War. This was the world's largest military airdrome and dwarfed all other airfields in existence.

a major defensive effort. With her principal cities largely burned out, her arsenals and factories substantially destroyed, her transportation system overburdened (and in top priority for total destruction beginning in August 1945), her workers' dwellings reduced to ashes over widespread areas, and communications disrupted, organized economic activity and central government were rapidly becoming impossible. With the impending threat of tremendously increasing air assault, Japan, as a nation, was facing total destruction. It is true that Japan is a relatively small country, geographically, and her economy had been weakened through air and sea blockade. However, the final five months of intensive bombing, which accounted for 90 percent of the total tonnage, was conducted by only a part of the air force which eventually would have been thrown against her, even without considering the employment of the atomic bomb. During the period between March and August, 1945, the average monthly tonnage dropped on Japan proper was only slightly over 26,000 tons, whereas within a short time after August, 1945, Japan would have been bombarded by well over 100,000 tons per month. Had the war continued until 1 November 1945, B-29's alone would have dropped an additional 350,000 tons of bombs and mines on industrial and transportation targets in the Japanese homeland and, with three additional Air Forces, would have completely destroyed any and all target systems worthy of attack. In the final analysis, Japan, unable to oppose effectively a fraction of the planned air attack, was unable to survive as a nation.

b. What strategic conceptions must be adopted in order to exploit fully the military potentiality of air power?

(1) With respect to this issue, the Survey states:

Page 21: "The interrelation of military, economic, and morale factors was complex. To a certain extent each reacted on the other. In the final analysis the Japanese military machine had lost its purpose when it could no longer protect the Japanese people from destruction by air attack. General Takashima, when asked by the Survey as to his reaction to the Imperial Rescript, stated that surrender had become unavoidable; the Army, even should it repel invasion, could no longer protect the Japanese people from extermination."

Page 26: ". . . Nevertheless, it seems clear that, even without the atomic bombing attacks, air supremacy over Japan could have exerted sufficient pressure to bring about unconditional surrender and obviate the need for invasion."

Page 26: "The conviction and strength of the peace party was increased by the continuing Japanese military defeats, and by Japan's helplessness in defending itself against the ever-growing weight of air attack on the home islands. . . ."

Page 27: ". . . The first objective of all commanders in the Pacific war, whether ground, sea or air, whether American, Allied, or Japanese, was to assure control of the air."

Page 28: "Prior to the European war, we underestimated the predominant role that air power was to play and allocated to it too small a share of even the inadequate resources then available to the Army and Navy. . . ."

(2) **Pacific Strategy.** In examining this question (par.b) and the conclusions of the Survey which bear on this issue, it is appropriate that we consider our Pacific strategy. Was it a ground, sea, or air strategy? It was

limited to no one of these three. Our overall strategy, as planned, was a surface strategy designed to move ground forces into Japan for the decisive and final battle. In this strategy, air power was assigned the role of an ancillary force; its mission being to prepare for and support the invasion. In the execution of this strategy, however, air power was employed on a progressively wider basis, culminating in an air assault against Japan proper of sufficient strength to induce unconditional surrender *without invasion.* The primary mission of the strategic air force which ultimately forced early surrender was, however, to prepare for and support the surface invasion. The fact that the Pacific war was fought in three elements, with one of the three elements (land, sea, and air) predominating at different times, has misled some observers into describing it as an air war or a naval war. This was not the case. The three-dimensional tactics of the war were modern to a degree, but they stemmed from a basic strategy which dated back to a time when wars were fought in a single element. The core of our strategy in the Pacific, as also in the European theater, was to move ground forces into the enemy homeland for the decisive struggle. This basic concept dominated our military thinking during the war and during the years preceding the war, and was, thus, responsible for our strategy, our military organization, and for the weapons we were to use. Our air weapons, being considered in prewar years as ancillary weapons, were developed under this influence. This concept served to retard, rather than to accelerate, the development of range and firepower in combat aircraft and the overall capability of air power.

When the order of battle was drawn, it was this same concept which defined the relative roles of the three main forces and which governed their employment. In order to move ground forces into Japan for the final and decisive battle, we needed staging areas within reasonable range of the Japanese homeland and free movement of our Navy to effect and guard the transport of troops and supplies. But our Fleet could not move freely until it had won domination of its own element, and it could not achieve such control without advancing its line of bases for Fleet support. These bases had to be won by land, sea, and air action. Early experience dictated the need for air control over our advancing surface forces and over our lines of communication. To gain and maintain air control, forward bases were required from which the sustained force of our land-based aircraft could be brought to bear. Each element had its own logic of action and its own requirements. The basic aim of our strategy was invasion of the enemy homeland by ground forces but, since sea power and air power had to be enlisted to accomplish this aim, their strategies and logistic requirements had to be met along with those of the invasion itself. Thus the simple need for ground force staging areas snowballed into a full-fledged steppingstone campaign as the central strategy had to be expanded and modified to fill the needs of the forces enlisted in support of that strategy.

It is important that we distinguish between the overall strategy and the strategic needs of the forces assigned to carry it out. The overall strategy called for invasion and we committed air power and sea power to prepare for and support the invasion. By committing these forces, we also committed ourselves to the steppingstone campaign which is the most conspicuous feature of the early stages of the Pacific war. In the later stages, while our

full-scale amphibious invasion force was being readied, our long-range bombers, based 1500 miles from Japan and outside the operating radius of her land-based aircraft, carried sufficient tonnage of bombs to Japan to destroy her principal cities and industries and to convince her leaders of the futility of further resistance. For, even if Japan's intact home army should repel the invasion, it could no longer protect her people from destruction by air attack.

(3) As concluded by the Survey, the outcome of decisive battles of the past war was determined by air action. Yet air power, at the present time, is still in the early stages of its development as an instrument of military strategy. In reviewing the past war, one cannot but be impressed by the rapid advance in the overall combat capability of air weapons. At the outset of the war, our heavy bombers, under conditions existing in the European theater, had an effective combat radius of less than 600 miles, while our fighters were able to escort to less than half that distance. By 1944, our long-range bombardment aircraft were striking targets in excess of 1700 miles from their operating bases, while our fighters, by that time, were escorting bombers on missions requiring an effective combat radius in excess of 750 miles. The accuracy of instrument bombing and navigation during the early part of the war was extremely low and only with great difficulty could our bombers locate and hit even large industrial areas on the European continent by instrument bombing technique. By 1945, however, B-29's equipped with the latest airborne radar were striking Japanese targets at night and through the overcast with accuracy approaching visual bombing standards. A very large percentage of the total effective tonnage of bombs dropped on Japan was released by radar methods. Other means of instrument bombing which were being developed during the war promised great accuracy, had the war continued.

(4) This rapid advance in the capability of air power spells a message which is fraught with grave warning. Military strategy of the past has been revolutionized and, to be successful in future warfare, our military planners must take full cognizance of this fact. By the old strategic concept, in order to get at the enemy's source of power and productivity and to assure his ultimate and absolute defeat, it was necessary first to oppose and neutralize effectively his surface forces. This concept must be modified. Long-range air weapons now provide a rapid and effective means of striking directly at the enemy's sustaining resources and his will to wage war. Surface forces which do not have access to the medium of air offer no obstacle to this form of attack. In this new strategy of air, surface forces need be opposed and neutralized only as required in acquiring and/or defending necessary air bases. This strategy will therefore not serve to eliminate the need for surface forces, but will change their roles in war to a radical degree. In the future, *the range of air weapons and their ability to penetrate enemy air defenses will be fundamental considerations in the development of a nation's primary striking force.*

(5) The *time factor*, also, will become increasingly important in future warfare. It is extremely unlikely that, in any future war, we will ever be given the time to prepare for and conduct a steppingstone campaign of the type we fought successfully in the Pacific. This necessity must be eliminated by building into our air weap-

ons the required range and ability to penetrate enemy defenses. The mission of air power has ceased to be ancillary. It has become primary. For this reason, the old principles of military strategy which, in the past, have served us successfully, must give way to modern strategic concepts unless our national security is to be compromised.

(6) The ceremony on the deck of the battleship Missouri marked the defeat of a country with an undefeated army; an army which, although intact and equipped, was unable to prevent the destruction of its country by air attack. The Japanese navy elected to commit its remaining strength to total destruction in the two futile sorties of the Philippine Sea and Leyte Gulf. However, its presence at the last, like the Japanese army, would have offered no obstacle to the progress of our air attack.

(7) The following statements from the Survey Report are also significant to this discussion:

Page 10: "But along with all other military powers prior to the war, the Japanese had failed fully to appreciate the strategic revolution brought about by the increased capabilities of air power. The ability to achieve general and continuing control of the air was not envisaged as a requirement in their basic war strategy, as was the planned destruction of the United States fleet. Had this basic requirement been well understood, it is difficult to conceive that they would have undertaken a war of limited objectives in the first place."

Page 20: "One of the important factors inducing Japan's leaders to accept unconditional surrender was a realization that the Japanese armed forces had lost their ability to protect the people and that under the impact of direct air attack and lowered livelihood their confidence in victory and determination to continue the war were rapidly declining."

c. If air power does constitute a decisive force, what is the proper military organization to exploit its potentiality?

(1) Concerning the military structure with which we fought World War II, the Survey states:

Page 29: "In exploiting this superiority, greater economy of effort was possible. The structure of our prewar military organization provided no means, short of the President, for integrating our armed forces. Under the pressure of war, the Joint Chiefs of Staff was the most decisive mechanism then possible to fill this gap. Each of its members had in effect the power of veto and the required unanimity was produced by compromise. It proved impossible to agree on an overall commander for the Pacific as a whole. Our military and economic strength, however, made it possible to plan and execute a dual line of advance across the Pacific and to mount an air attack of sufficient weight to induce unconditional surrender concurrently with the preparation of a full-scale invasion."

Page 32: "Even though the United States did not achieve unity of command in the Pacific as a whole, each theater commander used the air, ground and sea forces assigned to him as an integrated or coordinated team. Coordination and compromise among theater commanders was largely achieved in all major respects. Such lack of complete integration as existed was in large measure traceable back through the structure of the Joint Chiefs of Staff to the basic structure of our prewar military organization."

Credit: U. S. Air Force

This group of well-ventilated Japanese Navy Jack planes at Atsugi Airfield, 32 miles from Tokyo, was typical of dozens of scenes of Japanese planes which were never able to get off the ground to assist in fighting the war. American air power had decisively humbled the Japanese Air Force, just as it had Japanese shipping.

(2) Under the section of its Report headed "Integration of our Military Establishments," the Survey has prefaced its recommendations for unification with a discussion of the failure of the Japanese military structure as follows:

Page 31: "Organizational deficiencies in the Japanese Government contributed to Japan's entering a disastrous war and subsequently contributed to the absoluteness of her defeat. The form of her governmental organization provided no means for civilian control of the military or for obtaining effective coordination between the Army and Navy. Military policy was inconsistent with the foreign policy of the cabinet, the Japanese Army and Navy tending to make their own foreign policy in accordance with their individual aims, capabilities, and requirements. During the war, bureaucratic rivalry between her Army and Navy impeded coordinated strategic and tactical planning, the proper employment of her air power, the development of adequate logistics, and the efficient utilization of her economic resources. The existence of such joint or combined organizations as the Supreme War Council, the Supreme War Direction Council, the Board of Field Marshals and Fleet Admirals, and the Imperial General Headquarters, served mainly to hide the fact that real unity, integration, and coordination were conspicuously lacking."

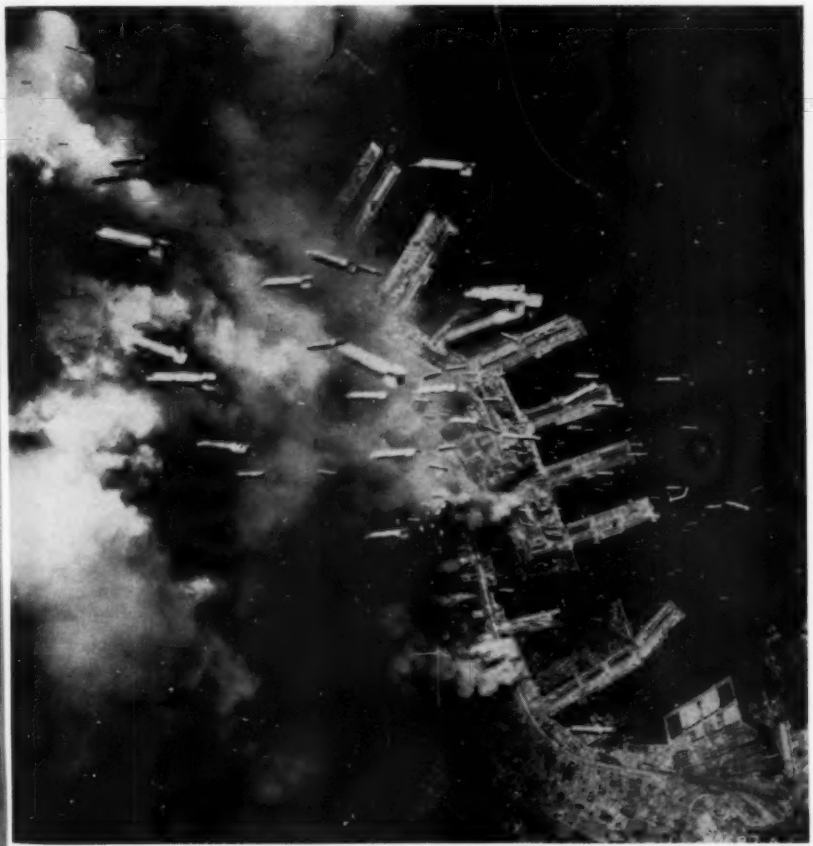
(3) In many respects the Japanese military system corresponded to our present system. In evaluating its overall effectiveness, the Survey has taken a wise step, since a system operating under extreme pressure is more likely to expose its basic deficiencies than one which is subjected to a lesser degree of pressure. Facts assembled by the Survey disclose the serious failures of the Japanese system under the demands of total war. In defeat, the

serious deficiencies of the Japanese system loom large before us whereas the corresponding weaknesses of our system are to a degree obscured by our victory.

(4) In addressing itself to the important issue of unification of our present War and Navy Departments, the Survey has taken a broad stand in favor of unification with the following statement:

Page 32: "The Congress of the United States is today considering legislation for the reorganization and integration of our military establishments. The Survey is of the opinion that the prompt passage of appropriate legislation is in the national interest."

(5) However, the Survey's broad stand on unification has been weakened by a further statement which attempts



Credit: U. S. Air Force

The raining down of incendiary bombs on Kobe, Japan, June 5th, 1945, marked the third straight Superfortress raid on the commercial docks of that area. Missions such as this helped strangle Japanese shipping, which was one of the life lines of that insular Empire.

Credit: U. S. Air Force

A circular view of demolished Hiroshima shows the almost total destructive power of the first atomic bomb employed in war. Reinforced concrete buildings and bridges remained standing, though badly damaged. Note the small water crater in the roof of the reinforced concrete building in the foreground.

to define the military mission of the third coordinate establishment and which implies that air power should be divided up between the Army, the Navy, and the Air Force. The Survey Report states:

Page 32: "Within a department of common defense which provides unity of command and is itself oriented toward air and new weapons, the Survey believes that, in addition to the Army and the Navy, there should be an equal and coordinate position for a third establishment. To this establishment should be given primary responsibility for passive and active defense against long-range attack on our cities, industries, and other sustaining resources; for strategic attack, whether by airplane or guided missile; and for all air units other than carrier air and such land-based air units as can be more effective as component parts of the Army or Navy. The mission of such a new establishment would differ considerably from that of an autonomous air force and would require broader experience than has been included in the Army

Credit: U. S. Air Force

The splintering of large trees and the warping of concrete buildings 2,200 feet from ground zero at Nagasaki reveals the powerful force and impact of the blast effects of the second atom bomb. The charred cement structures show the results of the tremendous heat and radiation released. The hospital or sanatorium, nestled several miles in the distant foothills suffered only minor blast damage.

air forces alone."

(6) Facts assembled by the Survey give full support to its conclusion that a third establishment is required in the immediate interest of national security. However, no factual data gathered by the Survey will support its prediction of the mission for the third arm. In defining this mission, the Survey is preconceiving the pattern of future war and is restricting and limiting the agency which operates in the third element to passive and active defense and long-range attack. It is imperative that no military arm be restricted in the scope of the operations it may conduct in its own element. It is patently impossible today for any agency to predict the time or pattern of a future war, and it is mandatory that the mission of the Air Arm not be restricted—but that it be defined in the broadest possible terms. The Survey's restrictive definition is nullified, rather than supported, by the factual data which it has assembled.

(7) Likewise, the Survey's implied proposal to trisect the Air Arm between the Navy, Army and the third establishment cannot be supported by

the data which was assembled. This proposal is contrary to the broad objectives of unification and, if adopted, will effectively vitiate the military potentiality of air power. If this policy is pursued, air power will be robbed of flexibility and will lose the ability to effect decisive concentration during that phase of war wherein air operations constitute the major effort. It is elementary that, in the air phase of a future war, the total air potential of the nation must be able to effect this decisive concentration and equally elementary that, in the joint phase of operations, the full weight of air effort must be organized and directed to give maximum support to surface operations. The establishment of specialized aviation within the ground arm to perform only surface support operations and the assignment of land-based aviation to the Navy would, in effect, produce three competing air forces and would prevent the effective employment of the air power of the Nation.

(8) The primary mission of Air in the future will cease to be ancillary and it must, therefore, assume a broad responsibility to the Nation. Within this new Department of Air, it is important that we concentrate our air strength and centralize the responsibility for development of our future air weapons. In attempting to achieve unification, we are striving to concentrate our sea forces, our land forces, and our air forces under three coordinate commands which will function as an integrated team under central command. If our efforts toward unification are successful, these forces, each properly organized and balanced in accordance with the requirements of our overall military objective, will be trained in peacetime to function as a team and will converge in battle under a single commander. Their military roles will be distinct but interrelated. The proposal to establish air arms within our land and sea forces is designed to increase the independent operational capability of our land and sea forces—which it would do at the expense of our overall combat capability. This implied proposal, if adopted, will serve to perpetuate the present cleavage between our component forces and will invite continued competition and duplication. In my opinion, this proposal is nullified by all of the experience of the past war and by the data assembled by the Survey itself.

8. Briefly, then, the fundamental answers which must be made to govern our national security program are specifically found at various places scattered throughout the text of the Survey's Report and may be stated simply as follows:

a. Question: Does air power, properly developed and supported, constitute a primary striking force of such characteristics that it can achieve victory over our enemies by destroying their sustaining resources and will to wage war?

Answer: As shown on page 28 of the Report, the Survey's answer is a positive *Yes.* ". . . It further supports the findings in Germany that no nation can long survive the free exploitation of air weapons over its homeland. . . ."

b. Question: What strategic conceptions must be adopted in order to exploit fully the military potentialities of air power?

Answer: The Survey Report provides the essential elements of the basic concepts in the following words:

Page 28: ". . . For the future it is important fully to grasp the fact that enemy planes enjoying control of the sky over one's head can be as disastrous to one's country as its occupation by physical invasion."

Page 26: ". . . air supremacy over Japan could have exerted suf-

ficient pressure to bring about unconditional surrender and obviate the need for invasion."

Page 21: ". . . surrender had become unavoidable; the Army, even should it repel invasion, could no longer protect the Japanese people from extermination."

Page 27: "1. Control of the air was essential to the success of every major military operation. . . ."

These statements need only to be phrased in generic terms in order to establish the sound strategic conceptions which must be adopted.

c. Question: If air power does constitute a decisive force, what is the proper military organization to exploit fully its potentialities?

Answer: The answer to this question lies in the Survey's statement, page 32: "Within a department of common defense which provides unity of command and is itself oriented toward air and new weapons, the Survey believes that, in addition to the Army and the Navy, there should be an equal and coordinate position for a third establishment. . . ."

9. The following additional comments on the Summary Report are made, not for the purpose of criticizing the findings of the Survey, but in an attempt to assist in a clearer and more precise appraisal of its findings.

a. The foreword of the Summary Report states that the United States Strategic Bombing Survey has not undertaken to apportion credit for victory among the various component Allied forces. Unfortunately, the Report does not abide closely by this stated thesis, but, on the contrary, at times follows a statistical approach at the expense of a realistic evaluation of the military problem. In so doing, the Report inevitably provides a basis for faulty comparisons and conclusions which may be quoted to support fallacious argument.

b. The general statistical pattern which was followed compares and contrasts measures of destruction and damage without relating these figures to the elementary factors which are essential to a solution of the military problem. Statistics may be used to support the solution of a military problem, but they may easily lead to fallacious conclusions if not properly evaluated. For example, the primary mission of submarines is to sink ships. In the furtherance of this mission, they devoted practically all of their effort in the Pacific and sank more than 50 percent of the Japanese merchant fleet. The Army Air Forces sank only 19 percent of the Japanese merchant fleet, according to the Survey's figures, but, in so doing, *devoted only 1.7 percent of their total effort.* This later fact is neither analyzed nor stated in the Summary Report. Simply the figures on tonnage sunk are presented. This type of presentation, even though innocent of bias, can easily confuse the layman and invites an improper evaluation of the potentialities of weapons. Additional similar treatments occur throughout the text.

10. While I have been critical of the lack of pointed emphasis and projection of the Survey Report, I am not unaware of the difficulties under which the investigation was conducted. The technical nature and the extent of the data which was assembled and processed demanded that the Survey rely upon both the Army and Navy representatives for advice and assistance relative to technical aspects and strategic and tactical appreciations. The advice and information received by the Chairman's Office was widely divergent concerning many major issues. This made the problem extremely difficult. To the Chairman's

Office fell the difficult task and responsibility for accepting, rejecting, adjusting, evaluating, incorporating and discarding—regardless of the reactions of the personalities and Services involved. However, even though I am fully aware of the difficulties encountered by the Survey, I consider it unfortunate that the fundamental conclusions of the Summary Report are, to a degree, obscured by less important material and the lack of pointed emphasis. For this reason, I have considered it necessary to submit this memorandum. However, in the final and broad analysis, may I reiterate that in my opinion the Summary Report provides, with certain exceptions previously noted, fundamentally sound answers to current major issues relating to our military policy, and constitutes a basis for evaluating air power as an instrument of future military strategy.

/s/ ORVIL A. ANDERSON
Major General, U.S. Army

AIRMAN'S BIBLIOGRAPHY

MITCHELL: PIONEER OF AIRPOWER, by Isaac Don Levine, New York: Duell, Sloan & Pearce, 1958. 420 pages. Illustrated. $6.00.

Many people talk about Billy Mitchell, but few seem to know very much. The few who do know have read Isaac Don Levine's book, *Mitchell: Pioneer of Airpower,* which must certainly rank among the first half dozen titles on any list of permanent, basic air-age reading.

Written fifteen years ago, in the midst of World War II, this 420-page volume, based on Mitchell's personal papers now in the Library of Congress, remains the most extensive, best documented biography of America's most colorful, most controversial, most influential, and most farseeing advocate of airpower.

The new edition of the book, as the first selection of the Airpower Book Club, is the obvious right choice. No member of the Air Force, past or present, can afford to overlook this opportunity to make or to renew, as the case may be, the acquaintance of the fabulous Billy.

The fame of General William Mitchell rests, essentially, on four things:

One, he was the world's first great combat air commander, the first to employ airpower in mass in war;

Two, he was the first to demonstrate, by the sinking of the battleships, the potential of the air as the decisive category of conflict, whether the theater of surface action be the land or the sea;

Three, he realized that traditional military organization was inadequate to meet the responsibilities, the dangers, and developments of the future, and therefore advocated the unification of the military services under a department of national defense and the coordination of all aviation matters under a national department of aeronautics;

Fourth, he recognized, and insisted, that the coming generation should recognize that the conquest of the air heralded a new age, in which time and space would acquire new meanings, in which the technological revolution—of which airpower was the salient feature—would accelerate continuously, and

in which not only would conventional warfare be superseded but all warfare would eventually be rendered obsolete.

This is a remarkable record of accomplishment, showing vision of the widest possible angle. Indeed it would be difficult to name not merely another officer but another American of Mitchell's time who possessed the same ability to absorb, evaluate, synthesize, and project new ideas.

How did Mitchell get that way? What was he really like? One of the principal merits of Mr. Levine's book is the emphasis it places on Billy's background and on the influences that formed his character.

Mitchell was born "different." Great patriot that he was, he first saw the light of day in Nice, France. His childhood was distinctly patrician. His wealthy Scots grandfather enjoyed a local reputation as "The Rothschild of Milwaukee," and his father was a Congressman and later a United States Senator. Yet when the Spanish-American War came in 1898, young Billy quit college and enlisted as a private. He was soon commissioned in the Signal Corps volunteers, however, and rapidly won his silver bar. Despite his extreme youth, his talent for commanding men and dominating unusual situations was well demonstrated in Cuba and the Philippines. When he came out of the Philippines, he was the youngest officer in the Army. On April 27, 1901, he entered the Regular Army as a first lieutenant.

In the ten years after Kitty Hawk, Mitchell filled many routine Signal Corps assignments, experimenting with kites, balloons, wireless, photography—never in a routine manner. The period was punctuated in 1908 by the Wrights' arresting demonstration flights in America and in France. Mitchell was present at the Fort Myer trials and there met Orville Wright—in the social sense. But he was never one of the pioneer group like Lahm, Foulois, Selfridge, Milling, and Arnold, whom the Wrights taught to fly.

The break for Mitchell came after a second Philippine tour and a visit to Japan to study the military system, including the buildup of an embryo air service. On his return, Captain Mitchell was appointed to the Army general staff—at thirty-two the youngest officer ever so assigned—and placed in charge of European military information. War was in the air; in fact, in the Balkans, the fighting had already begun. Mitchell and not a few others were startled to learn that in the five years since Fort Myer twenty-six countries had expended $100,000,000 to develop military aeronautics, while the United States had grudgingly invested less than $500,000. Billy and the small band of Army flyers rose to meet the challenge.

Although not in favor of a separate Air Corps, Billy wanted to press development of the combat features of the airplane. "Our object," he declared, "is to develop aviation in this country. We have all of a sudden awakened to the knowledge that we are behind. . . ."

From his place on the general staff, even before he was a flyer, Billy was maverick enough to criticize the national military policy and call for a "council of national defense" to coordinate the Army and Navy, to put, "the whole national defense brains under one roof," as he put it. At the same time, expecting America to enter the war at any moment, Mitchell took up flying. At thirty-six he was too old for a service school, so he enrolled with the Curtiss Company and paid for his own lessons. But he also took instruction from some of the Army flyers, notably Tommy Milling, the crack pilot of that day. Consumed with the urge to get to Europe and see at first hand what was happening in the air, Billy somehow wangled leave and sailed. He had been in Spain only a few days when, on April 6, 1917, news reached him of the American declaration of war.

The rest of Mitchell's career is well known, for seldom has a serving miiltary officer received—or sought—so much publicity. His exploits over the lines in France, his "getting in the pocket" of the great British air leader, General Hugh Trenchard, his winning from Pershing the command of all American aviation at the front, his use of 1,500 airplanes in mass in the St.-Mihiel and Meuse-Argonne offensives, his fight after the Armistice to obtain for America the ocean-crossing types of German dirigibles, his creation of the first combat air force in the United States

history—the First Provisional Air Brigade—and his use of it to sink the battleships in 1921 and make simulated bombing attacks on east coast cities, including New York—all this is history, indelibly written in the annals of airpower.

How it all ended in court-martial and in Billy's resignation from the Army is also well known—known but little understood and often grossly misinterpreted. Mitchell's greatest notoriety and his fall from grace resulted, strangely enough, not so much from the things he did as from the things he said, and more still from the way he said them. If, for most Americans, World War I had been the "war to end wars," it was quite something else to Mitchell. While the nation was preoccupied with "getting the boys out of the trenches," with the "return to normalcy," with the limitation of armaments, Billy was burning with the memory that America had gone into its greatest war unprepared in the air, that American industry and ingenuity had never overcome the initial handicap, and that his flyers had to get their airplanes and their training largely from non-American sources.

What rankled even more was the refusal of the War Department to admit that aviation, however handicapped, had proved its worth in battle and had developed leaders, as well as tactics and techniques, capable of working out the destiny of the air services independently of the older arms. As the spearhead of that leadership, Mitchell looked with natural impatience to the day when he would be given the top air job and a free hand to build the nation's airpower.

Quickly disillusioned by the intransigence of his departmental superiors, he tried for four turbulant years to lead from the No. 2 spot as Assistant Chief of Air Service. When, after that one dazzlingly energetic term, he was neither made Chief nor even reappointed as Assistant but was exiled to a remote station in Texas, Billy resolved to bypass even the White House and take his case to the American people.

In the late summer of 1925, with the twin air disasters of the airship *Shenandoah* in Ohio and of a flight of Navy planes in the Pacific, Mitchell exploded with the famous accusation: "These accidents are the direct result of the incompetency, criminal negligence, and almost treasonable administration of the national defense by the Navy and War Departments." He was promptly charged with "conduct of a nature to bring discredit upon the military service" and was brought to trial—with the result that all the world knows.

Whether or not he was wise to take the course he did will probably always be debated. Sentimentalists continue to say that the verdict of guilty and the harsh sentence from the Army he loved broke Mitchell's heart. Those who knew and understood him best know otherwise. To Billy, all that really mattered was the cause of airpower, and he believed he had served it in the best and most dramatic way open to him. He harbored no bitter feelings.

Before the excitement of the trial had died away, Billy Mitchell, private citizen, was lecturing and writing for airpower as vigorously and as lucidly as ever. His vision never dimmed. A few years before his death, he published his last aviation book, *Skyways*. Though twenty-eight years old now, it is full of lessons, of wisdom, for today and tomorrow. In the dedication, addressed to his then little daughter and baby son, he wrote: ". . . My children . . . in their lifetime will see aeronautics become the greatest and principal means of national defense and rapid transportation all over the world, and possibly beyond our world into interstellar space." A proud legacy from a gallant and gifted leader.

M. W. McF.

SAC, The Strategic Air Command, by Richard G. Hubler, New York: Duell, Sloan and Pearce, 1958, 280 pages, $4.95.

The American public urgently needs a book explaining the doctrine of the Strategic Air Command, the historical origins of SAC, its status within the military establishment, its weapons, activities, leaders, personnel, problems and prospects. Above all, they must acquire a good understanding of

what the prime American military force is all about and what the U.S. hopes to accomplish with it. Richard G. Hubler has written an important, interesting, and eminently readable book which fills this requirement in an impressive manner.

At this stage of the game the effectiveness of the Strategic Air Command has not been tested in battle. It is as yet uncertain whether its great mission of deterring World War III can be accomplished successfully until the demise of the Soviet threat. Hence the time has not yet come to write SAC's history, and obviously no history based on exacting documentary research could be published today without violating security. But the author has told the SAC story (not history) in a convincing manner and has produced as informative an account of American strategic air power as can be written under these limitations. While inevitable gaps remain, the book breaks fresh ground, retells many significant events which must not be forgotten, and, in all, provides considerable insight into SAC's operations and tribulations. Incidentally, this is the first book which tells the story of one of our combat "commands" which in the post-war period have been replacing the "services" as the sword and the shield of the republic.

The author discusses his subject in the broad context of American security, as menaced by Soviet communism. He does not argue as though SAC is a cure-all for all problems, and he does not overlook the natural, technical, human and budgetary limitations inherent in strategic air power. In his survey of the B-36 controversy, for example, he is careful not to overstate the case for this bomber which, while the best available at the time, did have shortcomings. Hubler does not hide the fact that not all of the limitations from which SAC is suffering are due to inadequate budgets and unsound military traditions: some of them arise in SAC itself.

The difficulty which confronted the author was that, on the one hand, he tried to show the capability of SAC and the outstanding job the command is doing in keeping a 24-hour watch over this country. On the other hand, SAC is not given the means it needs. Although it still is the best-endowed force within the U.S. military establishment, its capability remains curtailed, regardless of its qualitative performance. The weaknesses of SAC are compounded by the circumstance that other forces are not yet properly integrated into the overall American strategy as epitomized by SAC; that the effectiveness of air defense is as yet low and the vulnerability of the U.S. base complex high; and that overall strategic direction partly is weak and partly is weakened by shortsighted fiscal and national policies. The author treads a little too softly on those and other limiting factors. It is not clear whether he thinks that the time has come when the battle with the military traditionalists is less important than a real showdown with the Bureau of the Budget and high level economic advisers who do not seem to understand that SAC can remain the world's primary air force only if it is being strengthened in proportion to the growing threat and if its technical means are being modernized constantly. To have air power, the U.S. must stay ahead in the force level and technological races. SAC, as the author points out, is waging the peace. But to wage peace successfully, more money is required than at present is being spent. Even adequate military budgets would cost considerably less money than would be required to wage nuclear war, which starved military budgets and resultant strategic insecurity will almost inevitably invite.

According to the author, the philosophy of SAC is embodied in the following statement by an anonymous writer:

> "The way to solve a serious problem is not to distort or ignore it but to handle it; to take all precautions which prudence imposes, to accept the irreducible risks, to bear the required responsibilities, and to follow the dictates of one's conscience. To cringe before the enemy, to bewail fate even before it is known, to become paralyzed from fear

and pessimism, and to abandon oneself to the visions of apocalyptic horror is despicable. It is moral self-destruction to which atomic devastation would add little but physical confirmation and merited punishment."

A force which operates on such high and realistic principles will not fail if it receives the support it needs and deserves. Richard G. Hubler must be thanked for an admirable book which informs American readers about the force on whose fortunes and skills their survival will be depending for many years to come.

STEFAN T. POSSONY
Georgetown University and
Foreign Policy Research
Institute

GRAF ZEPPELIN, by J. Gordon Vaeth: Harper and Brothers, 1958, $4.00.

This biography of the singularly outstanding operational record of a German rigid airship and its great commander captures the attention of the reader at the first page and retains it to the last. The elements of romance and glamour are effectively woven into the historical narrative the author presents.

While gaining this reader interest, the limitations and capabilities of rigid airships are treated candidly and in realistic terms. That the rigid airship, dictated by its innate features, is basically a low-altitude (losing one-half of its static lift before reaching 18,000 feet) and low-speed air vehicle, and therefore, responsive in major degree to the vicissitudes of weather and wind, is clearly portrayed. This response to the weather factor was manifest in planning schedules and in the conduct of flights.

It was in combating these limiting factors that the value and profit of superior airmanship is brought very effectively into full display. The author reviews numerous occasions where Dr. Eckener successfully maneuvered the Graf Zeppelin through operational hazards that might have brought disaster to lesser pilot skill. He clearly discloses that pilot competence was the major factor in the outstanding operational record this airship established. The superiority in airmanship he so consistently displayed does not lend itself to challenge.

Any reader of this book, while being entertained, will gain a fuller understanding of the capabilities and limitations of the rigid airship as a means of transportation.

O.A.A.

THE ZEPPELIN IN THE ATOMIC AGE, by Edwin J. Kirschner: University of Illinois Press, Urbana, 1957, $3.50.

This book gives early evidence that its major purpose is the revival of the rigid airship and its incorporation, as a significant component, in commercial and military transportation systems. It opens with a chronological review on the growth of lighter-than-air craft, which has the support of historical fact. However, in its explanatory treatment of the progressive series of airship crashes it could profitably have given a little fuller treatment to the causes.

At least three of these operational experiences had such major influence on the history of the rigid airship that they merit a much fuller treatment than the author gives them.

(1) The book reviews the military employment of 100 plus rigid airships that were built by Germany for the Zeppelin raids over London. They made a series of impressive raids on London in the 1915-1916 period and then abruptly stopped,—long before the war had ended. A British DeHavilland airplane, with a newly developed engine of greater power, had increased its operating ceiling to 18,000 feet and this capability brought the Zeppelin raids to a

precipitate termination. On the final raid over London this interceptor airplane forced the airships to go above their static ceilings and thereby set the stage for the heavy landings that followed, in which at least five airships were destroyed, with others badly damaged. In this military role the rigid airship had fought its battle with obsolescence and lost it.

(2) In the author's treatment of the crash of the Roma, a semirigid airship bought from Italy at the end of World War I, he observes that it "became unmanageable, crashed into high-tension wires, and exploded." Here again the cause is missing. That cause was the almost instantaneous structural collapse of both the nose and tail. All control was lost and, from an altitude of 600 feet, the ship plunged into the ground at cruising speed. With 1,500 gallons of gasoline spewing over the wreckage, a gasoline fireball marked the end of that ship's career. Hydrogen, which was the lifting gas, was not the primary cause of that conflagration and it is extremely doubtful that the fire would have been less intense had helium been the lifting gas. However, in quest of alibi, hydrogen was found to be a major contributing cause and was banned from further use in lighter-than-air craft. Thereby, we lost the most efficient static lifting medium and reduced performance in the order of 40 percent.

This structural weakness, inherent in semirigid craft, was convincingly exposed in the test flights of the American designed and constructed RSI. The rigid nose of this semirigid ship collapsed at 58½ miles per hour. When redesigned and reinforced, it collapsed at 60. (The author of this review conducted those tests and, at their completion, submitted a final report which carried the conclusion that the semirigid airships had no measurable military value. We never built another.)

(3) The author makes the observation that the Akron was "wrecked in a stormy sea—due to navigational errors and a defective barometric pressure altimeter." A reasoned diagnosis of this crash will not support that observation.

The Akron had, as members of its crew, a minimum of four competent aerial navigators who, even under dead reckoning conditions, could compute approximate location at any time. But faulty navigation was not a contributing factor to this crash.

Nor did the ship rely on a single barometric-pressure altimeter; it carried a battery of them and consistently compared their multiple readings. But barometers measure atmospheric pressure direct, and altitude only by conversion. That conversion is based on sea level pressure, which drops and then rises rapidly during the passage of an active weather front, and produces inaccurate altitude readings if appropriate conversion factors are not applied. Airship pilots understand this barographic limitation as an altitude recording instrument and make adjustments for it.

But neither faulty navigation nor a faulty altitude recording instrument could have been a major contributing factor to this crash. Nor could lack of weather information have been its cause. Weather facilities aboard, headed by a competent meteorologist provided complete synoptic charts at 12-hour periods and continuous reports between the charting of those weather maps. The temporary loss of radio contact after entering the storm was not a contributing factor.

The course of the ship convincingly discloses that a command decision had been made to penetrate an active weather front. For the courage displayed in reaching this decision the commander should be commended, but, from the vantage point of hindsight, the soundness of his judgment might be questioned. The decision to withdraw after the ship had entered a strong descending current, a characteristic feature of all active fronts, kept the ship too long in this descending air which could not be countered by the power of its engines, and carried it to a watery grave in the Atlantic. What would have happened had the ship remained on its initial westerly course must be consigned to prognosticating minds. But one thing stands out clearly

in the test as it was actually conducted, the airship was the victim, not the master, of an active weather front.

This book, while endeavoring to give plausible justification to airship disasters, brings focus to the fact that the history of airships might have been different and better in many respects had a broader experience been at the helm during those critical tests. It is, however, difficult to find within the pages of this book support for the author's observation that the airship was not given a favorable opportunity to prove its worth. The tests to which the airship was subjected were extensive, costly, and time consuming. It preceded the airplane and then became outmoded by it as the sailing vessel, in former time, had yielded to the steamship.

The author fully covers the range of airship capabilities and treats their limitations through an optimistic vein. This feature will challenge the reader to diagnose values reached and probe for cause. With this attitude the reader will surely gain a broader comprehension on what airships can and cannot do in the field of military or commercial transportation.

O.A.A.

Recent Books

Aircraft Industries Association, *Aircraft Yearbook, 1957-58*, Washington, D. C.: American Aviation Publications, 1958, $6; —*1958*, an extract in paperback, Washington, D. C.: National Aviation Educational Council, $.75.

Clarke, Arthur C., *The Other Side of the Sky*, New York: Harcourt, Brace, 1958, $2.95. A collection of twenty-four science fiction short stories on satellites and flight to the moon by a recognized science writer.

Fraser, Ronald, *Once Round the Sun*, New York: Macmillan, 1957. Story of the IGY and its 64-nation setup.

Hodgkinson, Colin, *Best Foot Forward*, New York: Norton, 1958. Inspiring autobiography of an RAF flier who lost both legs in a flying accident, but continued to fly more than 100 combat missions.

Kornhauser, Arthur (ed.), *Problems of Power in American Democracy*, Detroit: Wayne State University, 1957.

Larkins, William T., *The Ford Story: A Pictorial History of the Ford Tri-Motor 1927-1957*, published by Robert R. Longo, $4.95 paperback; $7.95 hard cover.

Mackersey, Ian, *Into the Silk*, New York: W. W. Norton, 1958. Story of the Caterpillar Club, with a thrilling batch of tales of emergency jumps.

Mandrake, Charles G., *The Gee Bee Story*, published by Robert R. Longo, $2.00 paperback; $4.95 hard cover.

Majdalany, Fred, *The Battle of Cassino,* New York: Houghton Mifflin, 1958. Gripping account of the bloody World War II battle.

Miller, Ed Mack (ed.), *Tales of a Flier's Faith,* New York: Doubleday, 1958, $3.50. Collection of twenty air short stories on the lack of atheists in cockpits.

Moore, Byron, *The First Five Million Miles,* New York: Harpers, 1955, $3.75. Memoir of an ex-Air Service and veteran American Airline pilot.

Nichols, Ruth, *Wings for Life,* New York: Lippincott, 1957. Famed aviatrix recounts her career.

Sealy, Kenneth R., *The Geography of Air Transport,* London: Hutchinson University Library, 1957. A basic text.

Stewart, Oliver, *First Flights,* New York: Pitman, 1958, $5.50. Relates epic flights in aviation history.

Wallace, Irving, *The Square Pegs: Some Americans Who Dared To Be Different,* New York: A. Knopf, 1958. $5.00.

Recent Articles

Acheson, Dean, "The Illusion of Disengagement," *Foreign Affairs,* April 1958. Reasoned argument for maintenance of U.S. military posture contradicting George Kennan's thesis for withdrawal of American forces from Europe.

Alsop, Joseph, "Time Is Running Out on Us," *Saturday Evening Post,* March 15, 1958.

"Annual Inventory of Airpower," *Aviation Week,* March 3, 1958. Entire issue devoted to informative articles.

Clark, Evert, "USAF Gears for Space Challenge," *Aviation Week,* March 3, 1958.

de Seversky, Alexander P., "No More 'Little' Wars," *This Week,* March 23, 1958.

Donaldson, T. S., "Threshold of Space," *Flying,* June 1958. A preview of the X-15.

Ford, Pat, "Flying Tigers' Grandpop," *Flying,* March 1958. An account of the Chinese Air Force of 1911.

Kissinger, Henry A., "Missiles and the Western Alliance," *Foreign Affairs,* April 1958.

Langewiesche, Wolfgang, "The New Jet Air Liners," *Harpers,* June 1958. A primer for airline passengers.

"Men, Missiles and Moons," *Air Force,* April 1958. Complete issue devoted to the timely addresses at AFA's annual jet age conference.

"Outward Bound," *Time,* May 26, 1958.

Reynolds, Bruce, "Pioneer Mechanic," *Flying,* April 1958. The story of George Hallett and his prominent role in maintaining aircraft before World War I.

Riley, Major Daniel, "French Helicopter Operations in Algeria," *Marine Corps Gazette,* February 1958.

Spaatz, General Carl A., "Where We Went Wrong—A Plan for the Future," *Newsweek*, December 30, 1957. Former USAF Chief of Staff makes his case for unification.

Spaatz, General Carl A., "Men in the Air and Missiles," *Newsweek*, February 24, 1958. On manned vehicles and rockets.

Stehling, Kurt R., "Manned Space Station," *Aviation Age*, May 1958.

Wyman, General Willard G., "Highlights of Army Doctrine," *Armor*, March-April 1958. Version of classified lecture to the Air War College.

Yaffee, Michael, "Missile Spending Spurred by Soviets," *Aviation Week*, March 3, 1958.

Zeller, Anchard F., "Human Factors in Selected Multi-Engine Jet Aircraft Accidents," *Journal of Aviation Medicine*, March 1958.

NEWS ITEMS

Objectives of Air Force

What is the Air Force doing to improve our current capability to deter war? At the same time, what is it doing to build a *future* capability to meet the Soviet threat?

General Thomas D. White, AF Chief of Staff, was asked these questions by the Senate Preparedness Investigating Subcommittee and an unclassified version of his answers appear in the recently published Part I of the hearings on satellite and missile programs.

Here are the Chief of Staff's recommendations on things to be done to make our Nation safe:

The problem faced by the United States today is: "What can we do to achieve an assured superiority in developing a continuously effective deterrent while maintaining readiness to meet the threat of Soviet capabilities?"

We in the Air Force are addressing ourselves to this problem in a positive way and are seeking to accomplish the following:

To improve our present deterrent capability:

Accelerate the dispersal of the SAC strike force.

Improve SAC ability to respond instantly to any aggression by provision of the necessary alert facilities.

Improve the ability of the SAC tanker force to support the offensive effort by accelerating forward redeployment of the SAC tanker force.

Provide additional tanker bases in the northern part of our hemisphere.

Improve the quality of our SAC, TAC and air defense forces by modernization of missiles and aircraft, including both chemical- and nuclear-powered bombers and their supporting environments.

Provide adequate operation and maintenance funds to improve our current combat capability and maintain it on a continuing basis.

To achieve an assured superiority:

Concentrate on achieving useful missiles and spacecraft in operational quantities by (1) accelerating production of ICBM to achieve early significant operational capability and deployment; (2) accelerating production of IRBM to achieve early significant operational capability and deployment; and (3) proceeding with active space programs.

Proceed with a vigorous and sound research and development program to develop without delay a ballistic-missile defense composed of (1) ballistic-missile warning system; and (2) anti-ICBM missile.

Continue to expand our research and development programs in other areas.

Take steps to improve the collaboration among scientists of the free world.

A vital element in maintaining and improving the quality of our forces is the retention of highly trained and skilled personnel. Additional incentives for military careers must be provided for both airmen and officers, primarily in the areas of pay and housing.

In brief, we must maintain and improve our Air Force posture today while we phase in the weapons of tomorrow and press vigorously forward into the space weaponry of the more distant future.

Higher and Faster

The spirit of moving out "farther and faster" has pervaded the units of our first line of defense. Within a period of nine days, the Air Forces' F-104 challenged and broke the world's records for speed and altitude for manned ground take-off aircraft. Both the records were set by members of the 83rd Fighter-Interceptor Squadron of Hamilton AFB, California.

On May 7th, Major Howard C. Johnson pushed the new line aircraft to an altitude of 91,249 feet, bettering the 80,190-foot record claimed by the French just a week before. This 27-minute flight was made at Palmdale, California, and established a record for ground take-off aircraft. Experimental type craft have flown higher.

On the 16th of May, Capt. Walter Irwin flew two passes over Edwards AFB, California, and averaged 1,404 m.p.h., establishing a new world's speed record. On this particular flight, the Starfighter flew 196½ m.p.h. faster than the record established last December by Major Adrian E. Drew in a McDonnell F-101 Voodoo.

The Air Force has dubbed the 83rd as the first operational twice-the-speed-of-sound squadron in the history of aeronautics.

Shortly after the speed run, both Major Johnson and Capt. Irwin were awarded the Distinguished Flying Cross by General Thomas D. White, Air Force Chief of Staff.

Space Medicine Footnote

Readers of Dr. Hubertus Strughold's well-received article in the January issue of *The Air Power Historian* will be interested in learning that the academic rank of Professor of Space Medicine has been awarded him at the Air University's School of Aviation Medicine. Dr. Strughold is, therefore, the world's first Professor of Space Medicine. This title was one of the twenty-four conferred upon civilian members of the Faculty of SAM by Maj. Gen. Otis O. Benson, Jr., Commander, Randolph AFB, Texas.

As the medical branch of the Air University, whose headquarters is at Maxwell AFB, Montgomery, Alabama, the School of Aviation Medicine grants to teaching members of its staff the same academic status they would have at a comparable civilian institution. Dr. Strughold, who founded SAM's Department of Space Medicine ten years ago, has been known until now, as Professor of Aviation Medicine. Recognized as the most eminent living authority on human flight in space, Dr. Strughold now serves as the School's advisor for Research.

For those who may have missed the significance of Dr. Strughold's "Atmospheric Space Equivalence" contribution in the January issue, this 1954 address was based upon the 1950 definition of "space" formulated by the Department of Space Medicine for use in their research program.

LETTERS TO EDITOR . . .

Dear Sir:

. . . My congratulations to the editors of the *Historian*. It gets better with each succeeding issue and both my active duty and reserve officers are looking forward to its arrival each quarter. In fact, I must say that my copy is pretty dog-eared by the time it goes the rounds. Keep up the good work. As with "The Ugly Duckling" bit in the Jan. issue, let's tell everyone's story at some time! We have many such historical operations, the story of the organization, the men and the machines behind them. These military operations, the problems and their solutions (or failure) have made us what we are today. Pride and prejudice play greatly on our emotions, each feels that his was (is) the best outfit and rightly so! Professionally speaking, it's our job as Air Force commanders to bring that spirit to every man. The *Historian* is certainly adding realism to the daily growth of Air Power. We need to look back in order to properly focus on the future.

Best Regards,

DONALD C. PRICER
Lt. Col., USAF
Niagara Falls, N. Y.

Dear Sir:

. . . If I might make an additional comment, the caption on page 45 of the January issue dealing with the Albatros de Chasse deserves some attention, I think. The machine you call an "Albatross de Chasse" is an Albatros D. II, flown by such figures as Boelcke and von Richthofen. It appeared on the Western Front in 1916 in fairly large numbers as an improved version of the Albatros D. I. It was powered with a 160 h.p. Mercedes engine, and in spite of its power, as you say, it was somewhat sluggish. To say that it was "not too good in a 'dogfight'," however, is not quite correct. As a matter of fact, it was quite good against the average British aircraft against which it fought in 1916. Battle casualties will certainly attest to its superiority over many allied types. It might be of further interest to know that the particular Albatros D. II shown in your photograph was serially numbered 391/16, and was flown by a Lieutenant Büttner of Boelcke's squadron when it was brought down by the British on 1 December 1916.

Sincerely,

KIMBROUGH S. BROWN
Major, USAF
Eglin AFB, Florida

Dear Sir:

It is indeed a pleasure to be a member of THE AIR FORCE HISTORICAL FOUNDATION. Your publications are very interesting and professionally prepared. All financial dealings I have had with you have been preceded by extreme courtesy by your administrative personnel.

Unfortunately I can't submit any constructive comments on your January '59 issue. I read it with interest, but passed my copy on to another interested officer. Perhaps I should solicit memberships for the Foundation rather than passing on my edition.

Sincerely,

DAVID L. ROBERTS
Lt. Colonel, USAF
Washington, D. C.

(Ed. Note: Passing on your copy of *The Air Power Historian* is fine, but as has been expressed by the members of the Board of Trustees, it is our wish that each member of THE FOUNDATION will add at least one new name to our membership roster.)

NOTICE TO MEMBERS

All members are invited to attend the Annual Meeting of THE AIR FORCE HISTORICAL FOUNDATION, Friday, September 5th, 1958, at Bolling Air Force Base, Washington, D. C.

A combined business meeting of the Executive Committee and the Board of Trustees will be held at 1000 hours; a luncheon at 1230; and a symposium and discussion on the current proposals for the reorganization of the Armed Forces will follow immediately after the luncheon. The principal speaker for the afternoon session will be competent to discuss the official views on these proposals for improving our military posture.

Members are also invited to attend the morning executive session. Both meetings will be held in the Officers' Club.

A directing service will be available at the entrance gate.

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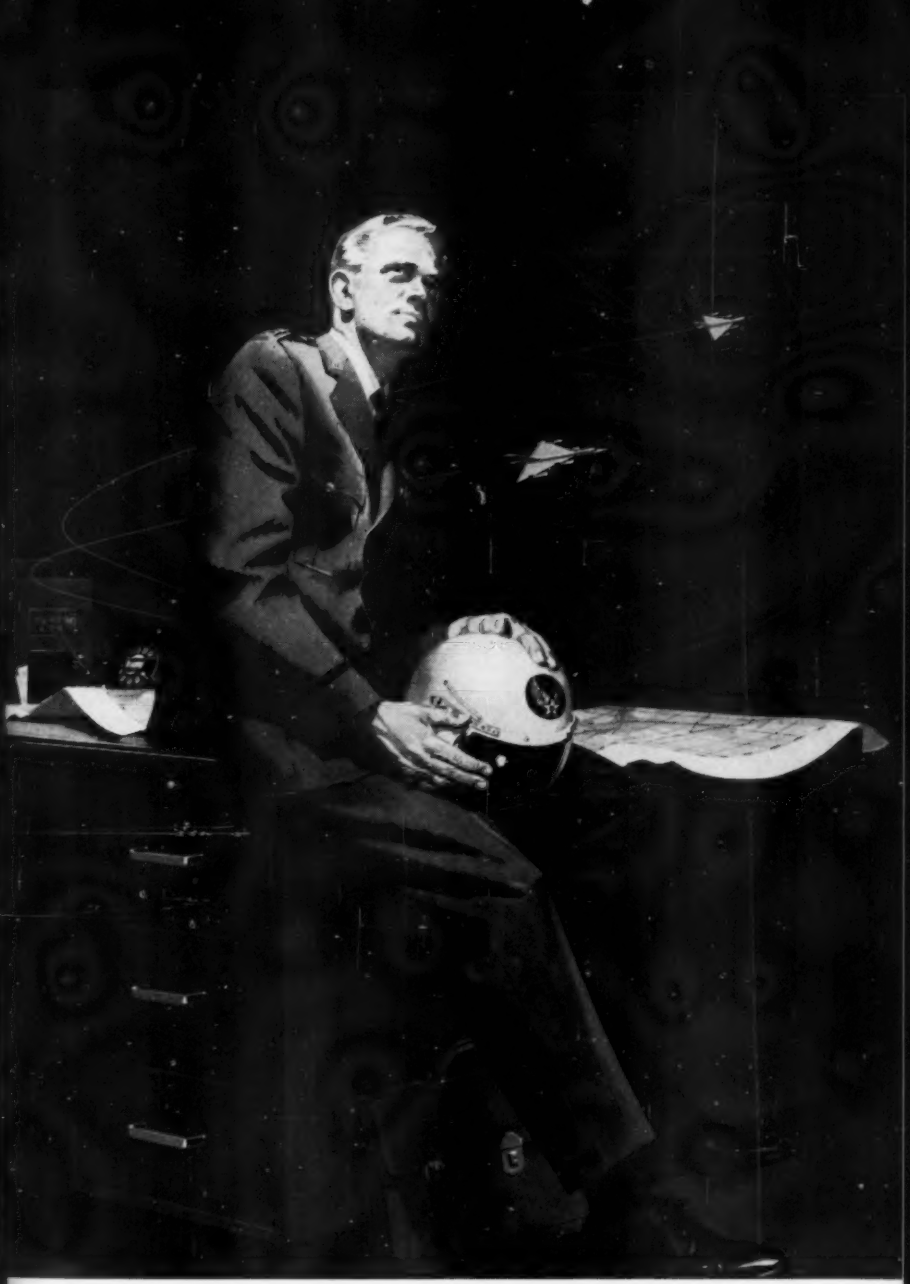

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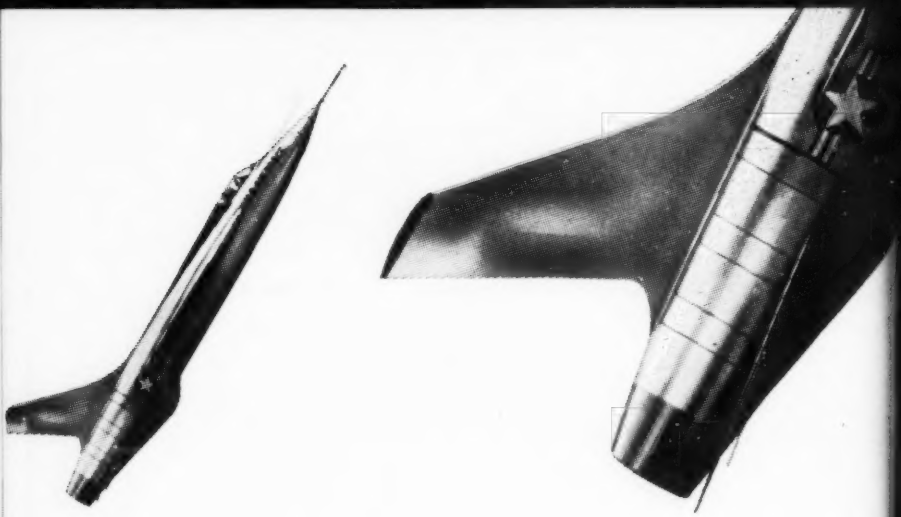

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